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The Bower-Barff Rustless Iron Company, of this city, has been awarded a special gold medal at the Cincinnati Exhibition.

The firm of WEIGHTMAN & WOLFF, consulting mechanical engineers of this city, has been dissolved, Mr. WILLIAM H. WEIGHTMAN retiring. Mr. ALFRED R. WOLFF will continue as the successor, making as his specialty advice relating to the economical production and use of steam and power.

ONE of our copper works has closed a contract for 1000 tons of from 4 to 5 per cent Newfoundland copper ore, a circumstance that shows that it would be possible for our American works to control the whole of that smelting business if the government would allow them the full drawback for copper in imported ores, when re-exported, instead of retaining a part of the duty paid, as it now does.

THE French government has appointed a commission to study the different questions relating to mining in Anam and Tonkin. The mining

members of this commission are LAURÉ-FLEURY, AGUILLON, FUCHS, and BOUTAN; while colonial and other departments are represented by GRODET DE KERGADAREC, GEORGES, PALASME DE CHAMPEAUX, and SANDRET. The commission, at its first sitting, determined to send two parties to Tonkin—one to explore the northeast and the other the northwest.

THE Treasury Department has decided that silver ore "which has been advanced in value or condition by grinding or by other process of manufacture, is liable to a duty of 10 per cent ad valorem." This, we presume, would apply to such material as concentrates of tailings from silver and gold mills that happen to be located in foreign countries. This decision does no one any good. It may put a few thousand dollars annually in the overflowing treasury of the United States, but, on the other hand, it injures many American mining enterprises in foreign countries, notably in Mexico, and may lead to the loss of a profitable business to a number of American smelting-works. It is certainly no "protection" to silver mining interests in this country, which, if they had any feelings on the subject, would rather see some high-grade concentrates go to our reduction-works. It is a small matter, of course, but it illustrates pretty well that some of the provisions of the tariff are a nuisance rather than a blessing.

LAST week, in alluding to the fact that large quantities of argentiferous copper ores and furnace material were going abroad, which should be treated in this country, we said that one of our refining-works was already working such material. We have been informed by the Orford Copper and Sulphur Company, the establishment referred to by us, that its work has gone much farther in this direction than we believed. It has, indeed, made the extraction of silver and gold from copper products a specialty, and has reached a capacity equivalent to the production monthly of 1,500,000 pounds of fine copper from silver-bearing stuff. It is now working on a lower silver margin than its competitors in England, and has followed a policy that departs strikingly from that of our British friends. No one who has had dealings with the latter has failed to experience disappointment with the final returns. By a multitude of charges, wonderful to the average American, and by peculiar methods of assay, the British smelters disguise the fact that the price for treatment is really much greater than it would at first appear. The Orford Copper and Sulphur Company pursues a different course. It simply pays 90 per cent of the assay value of the ore in silver, and charges a specific sum for treatment per pound of copper contained in the ore, the charge of course varying with the grade of the material in copper.

THE news of the breaking out of a fire in the Calumet & Hecla mine on Sunday last gave rise at first to grave fears. The latest accounts have pretty well established the fact that there is no cause for alarm, and that the fire is practically under control. As we understand it, the fire started in the eleventh level in the Hecla ground, between Nos. 3 and 4 shafts, which is entirely within the old stopes. There can be no doubt that a fire in this mine would cause very serious trouble, as the mass of timber in the old stopes, from the 15th level to the surface, is simply tremendous. The mine is an exceptionally dry one, and in the short stretch of 3300 feet, from Calumet No. 4 shaft to Hecla No. 4 shaft, there are in all 10 shafts, including the two mentioned. All of them pass through old stopes, and nearly the whole length above the 15th level and partly down to the 23d is one mass of timber. In the case of a fire, all of these shafts but one would have to be sealed, not a small matter in itself, and the task of fighting a fire of any magnitude by entering Calumet No. 5 shaft, over 1100 feet from Calumet No. 4 shaft, is not a small one. As it is, however, the fire started in the extreme south end of the Hecla ground in a position where it has not very much material above it. The two miners who were suffocated died in the attempt to approach the fire with the view to putting it out with water; but there would probably be less difficulty if approached after it has burnt upward from the level. In any case, even should the sealing of the shafts, already done, prove ineffectual, the fire can be readily directed along the south end of the ground. Water enough is available through the water-works.

As to the effect of the fire on the values of copper, nothing should be expected from it, because it has happened near the time for the closing of navigation, when the winter's supply of copper is already on hand. Besides this, the Black Hills mine, opened to an average depth of 800 feet, and without a stope in it, would be a reserve upon which the mill could draw. This ground is connected with the main workings by a single level only, the fifth, driven through fully 3000 feet of barren ground. There would probably be little trouble in putting a bulk-head into it, thus isolating the Black Hills mine. The mill, we understand, has been drawing its supplies this week from the pile of a few thousand tons of rock taken from the openings in this ground and dumped near it.

THE English technical journals just received are full of the reports of the Chester meeting of the Iron and Steel Institute. Like other societies,

this great association goes through periods of dullness, when little of professional interest comes up, when the papers fall off in quality, and the discussions are without spirit. Such a period it was apparently drifting into recently, and it is with great satisfaction that we note a vigorous revival. The papers were uniformly and exceptionally high in standard, and dwelt largely on subjects of immediate practical interest. Passing over that of Mr. AUBREY STRAHAN, of the Geological Survey, on the Geology of Cheshire, as appropriate merely because of the presence of the Institute in Chester, three general subjects were prominently brought forward, the manufacture of basic steel in the Bessemer converter and the open-hearth furnace, the construction and design of open-hearth furnaces, and the recovery of by-products in coking. The first paper brought forward and not coming within the scope of these three classes was that of Mr. HENRY SEEBOHM, a very prominent steel manufacturer of Sheffield, on the manufacture of crucible cast-steel. Coming as it does from such a source, it is highly interesting and of much value, though it will prove decidedly disappointing to those who might imagine that it contains some of the "secrets" of that famous trade, and of which he somewhat contemptuously says that they have no greater scientific value than the secrets of the Masonic fraternity. After all, the success of making good crucible steel appears to lie primarily in employing good materials and in exercising the greatest care in manipulating it during its entire process of conversion from a crude to a finished article. Mr. SEEBOHM'S description of the different stages of the process, and many practical hints which he throws out, make his paper exceedingly valuable; but he seems to be floundering about hopelessly in a sea of conjectures as soon as he attempts to explain theoretically the peculiarities of the metal. There is undoubtedly a splendid field for investigation. During the discussion, Mr. HALL, of the firm of JESSOP & SONS, Sheffield, spoke on the melting of Bessemer and open-hearth steel scrap in pots, and insisted that it was poor economy to use such inferior grades of crucible steel in place of metal made from Swedish bar.

We print elsewhere Mr. ARTHUR COOPER'S paper on the basic Bessemer steel plant of the Northeastern Steel Company, which was accompanied by an exhibit of the products made from it. During the discussion, it was conceded—which confirms the experience of the longer experience with the metal in Germany—that there can be no question as to the quality of the product. Mr. I. LOWTHIAN BELL quoted the experience of the Northeastern Railroad Company, which had received fully 50,000 tons of basic steel rails, and, so far as it was possible to judge from the limited service they had undergone, they were fully as good as acid rails. As to their chemical composition, the averages of a large number of analyses showed the following results: Carbon, 0.45 per cent for both; silicon, 0.105 for the acid and 0.06 for the basic; sulphur, 0.121 for the acid and 0.095 for the basic; manganese, 1.17 for the acid and 1.20 for the basic, the percentage of phosphorus in both being 0.05 per cent. Mr. W. WHITWELL referred to the fact that he had in vain tried to obtain steel as low as 0.085 in carbon, the only source of supply being basic steel, which elicited the information from Mr. COOPER that steel as low as 0.04 and 0.05 in carbon has been made and manufactured into shapes. During the discussion of the other papers, the basic process was only incidentally alluded to by M. GAUTIER, who stated that in France it was now spreading in the shape of the open hearth, in which there were no restrictions as to the kind of pig to be used, and in which it was possible to make the softest quality of steel, as a competitor of the best quality of iron.

The other papers referring to steel-making dwelt on open-hearth plants and the design of furnaces. First in order is that of Mr. FREDERICK SIEMENS on a New Method of Heating the Regenerative Gas-Furnace, in which he describes the modifications in the design of regenerative furnaces growing out of a change of views as to the correctness of carrying out the combustion. He insists that the furnaces should not be so constructed that the flame impinges upon the material, but should be so arranged that the flame only radiates heat upon the substances to be heated or melted. Mr. SIEMENS urges that his modifications will lead to more economical manufacture in glass-making, zinc-distilling, brick-making, steel-melting, etc. We shall submit his paper in full at a future occasion, with the accompanying drawings. The paper by Mr. JAMES RILEY, of Glasgow, the well-known metallurgist of the great Steel Company of Scotland, describes Recent Improvements in the Method of the Manufacture of Open-Hearth Steel, confining his remarks to the general arrangement of plant and the details in the furnace construction at the Blochairn and Newton steel-works. At the former establishment, Pernot furnaces, designed by the late Mr. HOLLEY, were put in, but failed, and the basic process was also tried for a while. The plant now in use is one comprising twelve 15-ton furnaces in a row. A series of experiments has been made during the past few years with different designs of open-hearth furnaces, among them being the "Baths" furnace, designed by HACKNEY & WAILES, which we shall illustrate in a future issue, and a furnace designed by JAMES RILEY and F. W. DICK, which was the subject of a special paper brought forward by the latter gentleman.

The third class of papers, that on the recovery of the by-products in

coking, includes two papers, one by WATSON SMITH, of Owens College, Manchester, giving an excellent summary of the literature of the subject and reviewing the different systems thus far brought out, and the second by Dr. C. OTTO, of Dahlhausen, Germany, describing the Hoffmann oven, drawings of which we have only recently printed. Neither the papers nor the discussion that followed their reading added any thing of importance to the knowledge already existing on the subject.

In conclusion, we can not help expressing a feeling of gratification at learning that the Iron and Steel Institute has by acclamation elected to the presidency for the coming year Dr. PERCY, the venerable metallurgist. His many friends in this country will be happy to learn of this fitting recognition of his services to the great iron and steel industry.

CORRESPONDENCE.

[Communications will be noticed only when accompanied with the full name and address of the writer. Unless specially desired, only initials will be printed. We invite criticism and comment by the readers of the ENGINEERING AND MINING JOURNAL. Replies not intended for publication should be addressed to the Editor of the ENGINEERING AND MINING JOURNAL in blank, stamped, and sealed envelopes. We do not hold ourselves responsible for the opinions of our correspondents.]

Chloridizing-Roasting of Ore Low in Sulphur.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: Of late, it appears to have become fashionable among American metallurgists to speak depreciatingly of the older German metallurgists, when comparing their methods (which it is so easy to consider as obsolete, because their opportunities are so rare) with those at present in use on this continent. I desire to put in a word in favor of the venerable Herren, to whom many of us owe so much, or to do this, at least in so far as "chloridizing-roasting without sulphur" is concerned. Bruno Kerl states expressly that evaporating chloride of sodium chloridizes certain metallic minerals directly. The words of the late Guido Kuestel, an exclusively German scholar (page 91 of his *Silver and Gold Extraction*, 1863), permit of no other interpretation but that he knew sulphur not to be a requisite unavoidable in chloridizing-roasting. He quotes sulphur as another important agent, the decomposition by heat alone of salt being imperfect. He even attributes the imperfection of chloridizing-roasting without or with but little sulphuret to the presence of antimony and of arsenic. This was twenty-one years ago.

In 1786, Von Born, who in 1796 assembled at Glasshutte, near Chemnitz, prominent metallurgists of the entire civilized world to show them Barba's improved amalgamation in copper vats (lately trumped up as a new Tina process), stated (so says Plattner) that "vitriol" (sulphuric acid) was almost a necessity for chloridizing-roasting. The influence of manganese ores is clearly stated by Plattner in his first edition, 1856. Plattner also states, page 267, that hydrochloric acid can be formed when the ore to be roasted contains admixed with it much free silica as quartz, because salt is very easily decomposed in contact with silica at a red heat.

F. M. F. CAZIN.

ELY, VT., Oct. 7.

The Hecla Concentrator.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: My first criticism as well as my letter in answer to Mr. de Stwolinski's objections to it plainly indicated that Mr. Knippenberg's so much advertised satisfaction with Mr. de Stwolinski's work did not possess for an unbiased judgment the virtue of completely covering manifest defects. It therefore can not cover them now under Mr. Knippenberg's new assertion of September 19th. I will, nevertheless, for the sake of the real cause involved, answer Mr. Knippenberg's questions.

1. In all cases, where for the purpose of illustrating theoretical discussion in matters of mechanical ore-concentration, I have made use (in my series) of facts only obtained from publications by the parties themselves. So also in the Hecla mill case, I referred to its description in the ENGINEERING AND MINING JOURNAL'S issue of December 9th, 1882. Although also I possess information from other reliable sources, I made no use of it, and it is absolutely irrelevant whether I have visited the Hecla mill or not. I may add that indeed I believe to be better informed as to the quality of its work than by his published reports (compare ENGINEERING AND MINING JOURNAL of February 17th, 1883, and March 15th, 1884). Mr. Knippenberg himself appears to be, for want of controlling by weight, sample, and assay all going into and coming from the mill. Should Mr. Knippenberg ever, as I sincerely hope for the interest of his enterprise, introduce such a control, and then find cause for dissatisfaction, I also sincerely hope that then he will not condemn mechanical ore-concentration as a totality. Let him remember then that he received timely warning in spite of his great satisfaction at the time, that his mill "can be made to do better," and that the warning came from a side absolutely uninterested either in the mill or in the people interested in it.

2. The Hecla mill, having cost in first outlay \$30,853.78, treated at the rate of 300 working days in 1883 (by Mr. Knippenberg's own published report; compare ENGINEERING AND MINING JOURNAL, March 15th, 1884), 89 tons a day (notwithstanding Mr. de Stwolinski's assertion that he will be able to handle 175 tons a day). The Hecla mill concentrated 6,888 tons into 1 ton at a cost of \$27.55, or of \$4 per ton of ore for loading, transportation, and concentrating. It is not improbable that the item "loading and transportation" remains considerably below 75 cents or even 50 cents in the average, thus making the mill cost appear \$3.25 to \$3.30.

In Michigan, where the quality of the ore demands the more costly stamping of the whole of the ore, the mill cost is on the Osceola \$2.20, on the Franklin \$2.35, on the Atlantic \$1.85. I do not desire to be understood as recommending either of these for use at Glendale, but as to cost of operation, I see no reason for avoiding comparison. And then these results leave not much cause to the Hecla for self-glorification; but, on the contrary, there appears to be much probability for the supposition that it might "be made to do better."

3. Mr. Knippenberg's query as to whether I "know any thing as to the character of the ores concentrated?" appears to absolutely ignore that the facts are stated in the mill description (ENGINEERING AND MINING

JOURNAL, December 9th, 1882). Four metallic minerals and their matrix are there named. A few more would technically not matter, as they are standard. If Mr. Knippenberg permits corroded surface ores at times to go to the mill, he should discontinue to do so, because this is in all cases waste of material and squandering expense of operation. But if ores consisting of sound mineral are sent to the mill exclusively, and if the attempt to concentrate pulp is not carried beyond economical necessity, then the Hecla's seventeen mines may pour out their entire variety, the more mixed the better; and it should make no difference to a mill, which was constructed in the full knowledge of what the ore is. If, nevertheless, it does make a difference, Mr. Knippenberg should permit me to assure him once more, that his mill "can be made to do better."

Trommels revolving on inclined shafts with inappropriate and insufficient variety of perforations are not the acme of perfection, nor are the Hecla jigs just the ones best adapted to the four minerals in the same ore and to the object of affording the furnace manager a chance to grade. The result of the imperfect sizing must be an inadequate distribution over the jigs; loss in capacity; increase in cost of operation; and increase in percentage of loss of valuable parts. At all events, Mr. Knippenberg, in order to get a good concentrator (the best in the land may eventually not be just what he would want, as it might be good for native copper and not for Glendale ores), will have to foster improvement in place of enjoying too thoroughly the plant he has.

As to Mr. Knippenberg's kind offer, I would say that, if at some future time he should have occasion for procuring under proper interchange of guarantees and securities a really good standard dressing mill, saving a high percentage and treating ore at about half the expense that his present mill does, then I shall be much pleased to indicate to him how he will be able to get it.

Mr. Knippenberg, then, may permit me to assure him that my judicious criticism did not "seek to destroy" any thing he or Mr. Walburn has, but has been inspired by the best of intentions toward both.

ELY, VT., Oct. 7. Very respectfully, F. M. F. CAZIN.

The Providencia Mine in the Manzanall District, Sonora.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: In the JOURNAL of September 20th, I find an abstract of a report by C. M. Rolker, on the Manzanall Mining District, Sonora, Mexico. The report, so far as it refers to the location of the mines and their formation, is quite correct. He must, however, err as to the tradition regarding the Providencia, which in brief, according to his report, was filled up by the Indians to hide the rich ore. If this be true, it is wholly unknown to the "oldest inhabitant," and would be peculiarly remarkable, as the only case where Indians have ever filled up an old mine to prevent the extraction of ore. His statement as to the size of the Providencia lode and the quality of the ore varies very much from that of well-known experts and the actual working results herein submitted. The first assay that I desire to submit, in contradiction to Mr. Rolker's statement, is that of Prof. I. E. James, a gentleman who, although not calling himself a mining expert, is admitted to be one of the finest mining engineers on the Pacific coast, and whose honesty and integrity and oft-tried judgment on mines have gained him the implicit confidence of the wealthiest mining magnates on the continent, namely, Haggin, Hearst, Tevis, Flood, Mackey, Fair, and the Grand Central, Contention, Carlisle, and other mining companies. He visited the mine in February, 1882, and after a prolonged investigation and thorough sampling of its ores, reported as follows. Providencia assay, No. 1: "Assay from north streak west (hanging) wall, from old workings, ore-body four feet wide. Silver, 51.65 ounces." Mr. Rolker, in his report, says of this identical ore-body: "The carbonate, where it is found in the soft hematite or ocher, occurs in fine particles, and would require to be dressed out. Without dressing, assays return from 5 to 6 per cent of lead and from \$6 to \$7 in silver."

Prof. James, assay No. 2, Providencia: "14 feet north of south wall, opposite shaft. Silver, 49.20 ounces." Of the same ore-body, Mr. Rolker says: "The quartz of the Providencia, which carries blotches of galena, returned, where exposed underground (no amount of ground is standing in the mine), from \$13 to \$18 in silver and 2 per cent of lead."

Mr. Rolker concludes the abstract of his report with the following assertion: "The quartz of the San Francisco vein averages about \$11.50 in silver. The Capitan, Echo, and Pollona galena and carbonate are somewhat higher, but not much." When the fact of the matter is, that the ore on the dump of the Echo and Pollona is too low to ship, not assaying more than 20 ounces of silver per ton, although it averages about 42 per cent of lead. In proof of the correctness of Professor James's assays, and as showing that the working results of the ore were above his samples, I submit the following returns, with accompanying settling sheets, from the Benson Reduction-Works:

	Prov. No. 1.	Prov. No. 2.	Prov. No. 3.	El Capitan No 1.
Net weight, pounds.	4950	2470	1838	2542
Silver, oz. per ton...	149.23	117.88	93.58	200.52
Gold.....
Lead, per cent.....	22	52	18	63

And this ore was taken out in about thirteen days by two men. Further, in refuting Mr. Rolker's statement regarding the quality of the ore, I will state that the ore above mentioned was "fairly cleaned pickings," while the waste or that portion left after the assorting, went far above Mr. Rolker's samples, as the following statement will prove: "Assays from Providencia mine made July 29th, 1884, from samples taken in person: Average of ore-dump, silver, 36 ounces; lead, 10 per cent; average of iron ore at top of winze, silver, 15 ounces; lead, trace; average of first-class galena, silver, 107 ounces; lead, 50.5 per cent. The above samples were taken with the view of buying the ores to ship to Tombstone, and I was careful that they should be below rather than above the true average, as the freight rates were high, and I did not wish to take any risks in losing money by freighting on ore that would not pay expenses.

J. D. GROESBECK,
"Metallurgist of the Woronoco Mining Company."

It will be observed from the above figures that the sampling of James, and also of Rolker, must have been taken from the low-grade ores, as the returns from the working of the second-class mineral more nearly conform with such assays. In submitting the above statement of facts and

figures, the only desire of myself and co-workers is to prove that all mines in Sonora are not frauds, and that, placing the most charitable view possible on Mr. Rolker's report, he certainly erred in judgment or did not make as full and thorough an examination as the merits of the property deserved. Our mines are always open to inspection; in fact, we cordially invite the impartial examination of experts and mining men. I remain, very respectfully,
TOMBSTONE, Sept. 28. C. M. THORNDYKE.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: Through your courtesy, I have been permitted the perusal of the letter touching the abstract of my report on the Manzanall Mining District, in specie, on the Providencia mine, Sonora, Mexico. The writer of this letter seems rather disappointed to find the report not more favorable. You say in the abstract of my report: "The district was formerly worked, but until a little over a year ago was made unsafe by Indian raids. Some of the old workings have been filled up, as the story goes, to prevent the Indians from taking out the rich ore that has been left." If the writer's knowledge of the English language is so limited that he understands from the above that the Indians filled the hole up, you will readily perceive that I must meet him in a conciliatory spirit.

With reference to the comparison of my assay samples with those of Prof. I. E. James, whom I have the pleasure to know personally, I beg to say that, before going to the mine, the professor was courteous enough to show me his note-book, read me all his assays taken from the Providencia property, and allow me to enter them in my note-book. Knowing these, and finding, to my mind, the appearance of the mine not in correspondence with these assays, I took the extra precaution to carefully clean every face where a sample was to be taken, and, when I thought it necessary, I cut into the face two or more inches to remove any possible particles of extraneous matter that might possibly have a tendency to deteriorate the sample. My assay samples give the result. I informed Professor James, shortly after my return to Tombstone, that my samples did not agree with his, and that they were materially lower.

I venture a correction in the letter of Mr. C. M. Thorndyke (I presume this is the same Thorndyke who fifteen months ago owned an interest in this mine), and suggest that it was probably in 1883, when Prof. I. E. James made the prolonged investigation, which, as the professor told me, if I recall right, amounted to one day, or at the most two days, on the Providencia. I followed him June 10th of the same year.

A comparison between sample No. 1 of Professor James and the one quoted from the abstract can not be made, except in the imagination of the writer; the two samples coming from entirely different places.

Neither can sample No. 2 of Professor James be compared with the assay quoted from the abstract, since Professor James had never seen the places from which they were taken, they being at the time either filled up or since newly cut. But why do the writers not quote some of the other assays of Professor James? He has also some not quite so high.

Providencia dumps I refused to sample, not knowing how they had been made, unless time would be accorded to run drifts through them, and use the material taken out in drifting for the sample. In case the sample proved the entire dump to be ore, so much ore would be allowed; but this ore was not to be taken as a standard to gauge the mine by. The time for the second payment being very close at hand, this was not done, since the amount of ore on hand, if the entire dump had been ore, would not have reduced the price of the mine sufficiently.

That hand-samples could be taken from the dump assaying up to 200 ounces I know; but they seemed rather scarce in the mine. It is barely possible that Professor James and myself sampled only the second-class ore in the mine; but the reason must be, that the first-class ore seemed to be limited principally to the dumps, or was in the filled-in portion of the mine. I also had some individual assays run higher than the averages; but the trouble was, the remainder of the samples was too preponderating and too little of the stuff yielding the high returns was to be found, so that the average was low. If it is a fact that the Echo and Pollona ore is too poor to bear shipping charges, I think my remarks about their richness are not very far out of the way, and 2542 pounds of Capitan ore, even if of high grade, makes no mine of it. I am aware of the fact, however, that many thought the Capitan vein a better vein than the Providencia.

Are we to believe that the 9258 pounds of ore, for which \$547.12 was received—out of which all mining, freight, etc., expenses, except reduction costs, have to be defrayed—are the sole product of this now famous Providencia mine—a mine for a seven-eighths interest in which the expected purchaser was asked to pay \$161,000, as he informed me? Let us hope such is not the case. Even sporadic occurrences of rich silver ore ought to make quite a good many tons in fifteen months' search after them, though it may not leave profits. If, on the contrary, the production has been small, I can understand why the property was offered me about seven months ago at \$40,000, on a four months' bond, with the confidential proviso that \$30,000 cash would buy it.

Even the expected purchaser, who was present during my examination, could not be tempted with this bargain when I informed him of it, and quietly congratulates himself on having saved his money.

My reason for permitting the extract to appear was, that it had come to my knowledge that I had been quoted as having made more favorable returns on this mine. I full well know the credulity of the public in mining matters.

Fortunately for Sonora, the Manzanall District is not the only mining district in the State. There are good mines in Sonora, we all know; but it certainly seemed to me that the Providencia mine at the figures asked for it was, to express it politely, no bargain.

NEW YORK, Oct. 8. Respectfully, CHARLES M. ROLKER.

SMOKE-CONSUMING APPARATUS.—The experience of the German railroads with smoke-consuming apparatus, according to a report made to the Technical Convention of the German Railroad Union, has not been altogether satisfactory, none of the apparatus tried having been entirely successful. Comparatively favorable results were obtained with a certain fire-brick deflector.

THE STURTEVANT MILL.

During the past few years, the principle has been gaining ground that the most economical means of crushing and pulverizing rock, so far as large capacity and a minimum wear are concerned, is to cause the attrition of the rock by impact of the particles of rock themselves. Ingenious contrivances, from a mechanical point of view, have been brought forward, but from inherent defects they have failed to gain a foothold. Some time ago, our attention was called to the merits of the Sturtevant mill, and we have followed its development, progressing cautiously, with great interest, and through the kindness of the Sturtevant Mill Company, No. 43 Chatham street, Boston, we are now in position to place before our readers an illustrated description of the machine. As a glance at our illustrations will show, the mill is composed of two cylinders or heads *B B*, Fig. 1, arranged on opposite sides of a case in which they are made to revolve in opposite directions. The rock being conveyed to the case through the hopper, is retained by a screen, and, entering the heads in revolution, is immediately thrown out in opposite directions with such force that the impact of the pieces of rock crushes them. The revolving head is shown, taken apart, in Fig. 3, being composed only of two pieces, one of which *E* is a simple metal cylinder or bushing, which when worn out can be easily replaced. When running, this head is filled with a lining of rock held in place by the centrifugal force. With the exception of the edges of the bushing, this lining protects the metal from wear. In fact, we understand that in the first little machine put together by the inventor to test the correctness of his idea, these heads were made simply of tin cans, and yet the little experimental apparatus, rough as it was, did its

NOTES FROM ALABAMA.

Special Correspondence of the Engineering and Mining Journal.

A few days ago, the Nashville *American* published the full text of a bill filed in the Chancery Court at Nashville, by Col. A. S. Colyar, as President of the Tennessee & Alabama Coal and Iron Company, against the Alabama Improvement Company for the recovery of \$650,000 for an alleged violation of contract on the part of the Alabama Improvement Company. The substance of the complaint of the Tennessee & Alabama Coal and Iron Company is embraced in the following extract from the bill:

"As is shown by said contract, the Alabama Improvement Company purchased of complainant \$650,000 of its capital stock, which stock was to be issued to the said Alabama Improvement Company on the payment of \$15,000 in cash on the 6th day of March, 1884, and the delivery of the covenant of the Alabama Improvement Company to pay complainant \$25,000 on the 26th day of March, 1884; the sum of \$20,000 on the 25th day of May, 1884; the sum of \$15,000 on the 25th day of June, 1884; the sum of \$15,000 on the 25th day of July, 1884; and the sum of \$50,000 of the first mortgage bonds of the Birmingham & Tennessee River Railroad Company when the same were issued by the said railroad company. Complainant shows the court that the Alabama Improvement Company complied with the said contract, so far as to entitle it to receive from complainant the amount of stock purchased, and said stock was accordingly issued by complainant to the Alabama Improvement Company. Complainant shows the court that the Alabama Improvement Company paid the sums of money agreed to be paid by said contract, due the 6th of

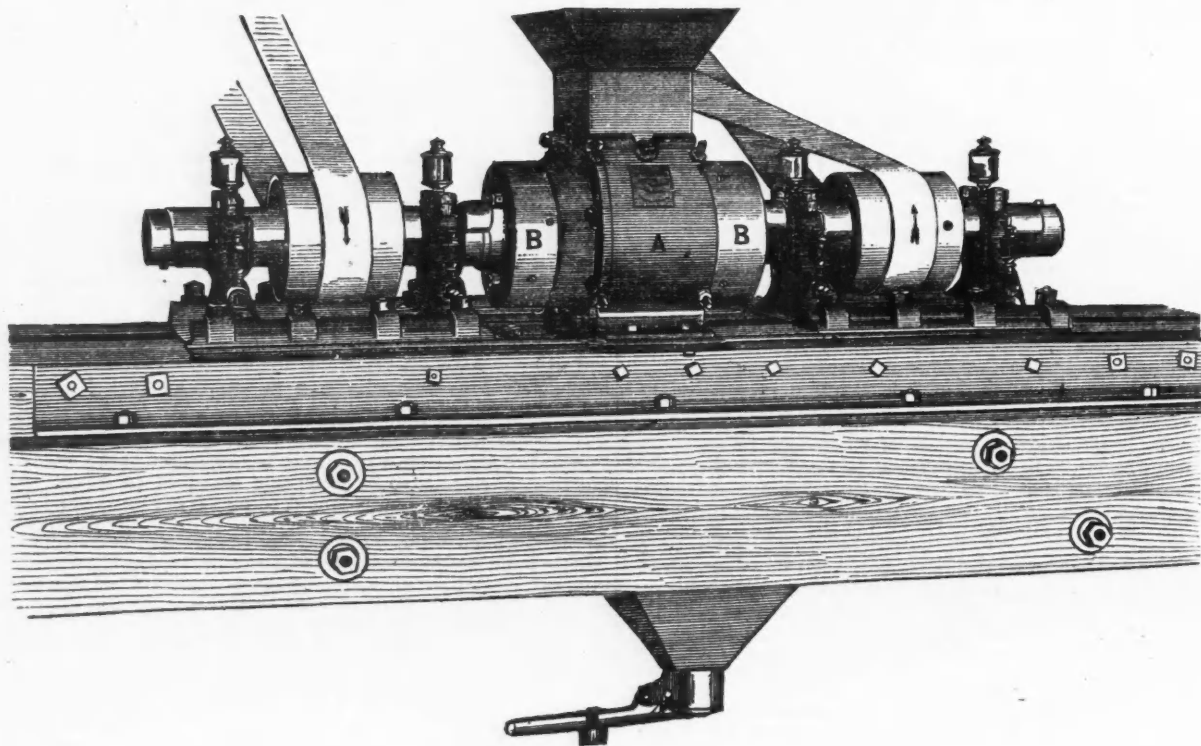


Fig. 1.

THE STURTEVANT MILL.

work. Fig. 2, which shows the interior of the mill, illustrates the position of the screen *C* through which the ground material passes and through which it drops from the hopper *D*. When uniformity of size is required, the coarse part is screened out and returned to the mill. The screen is made in small sections, which are easily transported and easily replaced. The wear of it is claimed to be slight, as it is protected from the action of the rock thrown against it by a cushion of interposing material formed by a portion of the rock that always rests against the screen. The Sturtevant Mill Company makes three sizes of portable mills—a four-inch, crushing from 100 to 400 pounds an hour, weighing 500 pounds, and requiring five horse-power; a six-inch, having a capacity of from 400 to 1000 pounds, weighing 800 pounds, and requiring seven horse-power; and an eight-inch, crushing from 600 to 1200 pounds an hour, weighing about 1300 pounds. It also makes three sizes of stationary mills—an 8-inch, 12-inch, and 20-inch—which are rated at from 1000 to 2000 pounds, one to four tons, and two to ten tons respectively, and require, in the order named, 13, 30, and 60 horse-power, and weigh about 1800, 4000, and 6000 pounds respectively. The 12-inch is claimed to be equal in capacity to a twenty-stamp mill, and the 20-inch equal to a thirty-stamp mill. The space occupied by the mill, in its different sizes, is very small, indeed, as compared with the rated capacity. The advantages of the mill, its simplicity, its low rate of wear, its lightness and compactness, will be evident at once from its design. It has, we understand, done excellent work on that *bête noire* of all pulverizers, phosphate rock, and is in operation on a large scale on other classes of work.

A LICENSE has been granted to the Railroad Coal Trade Tribunal by the Pittsburg Court, and the Board will immediately endeavor to fix the mining rate for the winter months.

March, 1884, the 25th of March, 1884, the 25th of April, 1884; but it has failed to pay, either in part or whole, the sums due on the 25th day of May, 1884, the 25th of June, and the 25th of July, 1884, making the sum of \$50,000, with interest thereon from the dates; and upon the amounts stated as due at said dates, no part of said railroad bonds have been delivered by the Alabama Improvement Company to complainant, and complainant is informed, believes, and so charges, that the Alabama Improvement Company is unable to deliver the bonds it covenanted to deliver as stated, and its embarrassments are such that it is not at all probable that it will ever be able to comply with the stipulations of said contract. Complainant shows the court that the railroad named was to be constructed by the Alabama Improvement Company; and when said contract was made, it was engaged in its construction; but by reason of its pecuniary embarrassments, it has abandoned the construction of said road; and complainant is informed, believes, and so charges, that the Alabama Improvement Company has totally abandoned the prosecution of its corporate business because of the want of pecuniary ability to continue its prosecution. Complainant shows the court that it was contemplated and intended by the complainant and the Alabama Improvement Company that the bonds agreed to be delivered to it were to be worth not less than 80 per cent of their par value, and complainant charges that, if the railroad had been constructed as was contemplated at the time said contract was made, bonds thereon of the character stipulated would have been on the market worth not less than eighty cents on the dollar. At the time said contract was made, the Alabama Improvement Company represented to complainant that the construction of said road would be prosecuted rapidly to completion by it; and if said company had complied with its representations and agreements, complainant would now be entitled to have possession of said road.

"Complainant therefore charges that the Alabama Improvement Com-

pany is justly indebted to it in the amount stated as due upon said contracts, and also the amount of said bonds at not less than eighty cents on the dollar."

Since the filing of the above bill, it has been withdrawn and suit dismissed. The reasons for so doing were stated as follows by Colonel Colyar to a reporter of Nashville *Banner*:

"It was prepared to be filed nearly a week ago, the reason being that the president of the Improvement Company had resigned, which fact and the stopping of the work impressed me that the building of the road was abandoned. But during this week, Mr. Jere Baxter came to me, and gave me, for the first time, the fact that he resigned because he had sold his stock to Mr. Willard Warner, of Alabama, who became president, and who is largely interested in building the road. Seeing that it was a movement for renewing the work, and by no means for abandoning it, I at once decided not to file the bill, and so notified the stockholders or some of them, in the Improvement Company."

Governor Marks was absent, but came home yesterday, and filed the bill as he had been directed to do, not knowing what had intervened.

Believing now that the parties interested are in earnest about building the road, which is the wish of the company, the bill has been promptly dismissed.

Messrs. Morris Brothers, operators of De Bardeleben & Underwood's

THE DISTRIBUTION OF SAN JUAN COUNTY ORES.—III.

By Theodore B. Comstock.

THE MINERALOGY OF THE SIX RADIAL ZONES.

2. *The Bismuth (Handie's Peak) Zone.*—Including those primary veins that trend from the Red Peak crater N. 50 degrees E.—S. 71 degrees E., with the parent fissure running about N. 79 degrees 30 minutes E., this area is unsurpassed in the prominence and extreme width of its fissures, as well as in their vast number and the great distances through which they may be traced without break of continuity. There is good reason for concluding that there are several parallel main fissures traversing the central portion of this tract, as if acting as vents from the Red Peak crater at different points along its rim. It should be remarked that this crater is of oblong shape, its greater diameter trending nearly in the direction of the axes of zones 1 and 4 (approximately N. 33 degrees E., and S. 33 degrees W.). The crater area being nearly five miles in length and barely one and a half miles in width, it will readily be seen how several of these fissures might have originated in each side zone. At any rate, the axial trend of the Handie's Peak zone (N. 79 degrees 30 minutes) is repeated several times in prominent veins on both sides of the median line. In a precipitous country like this, the so-called "apex" of the vein

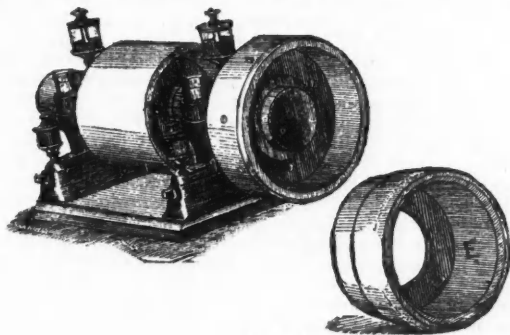


Fig. 3.

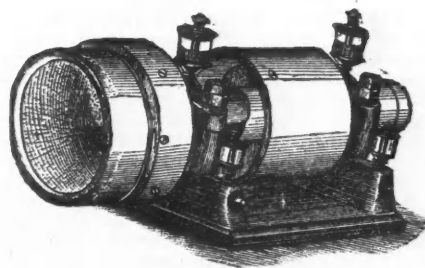


Fig. 4.

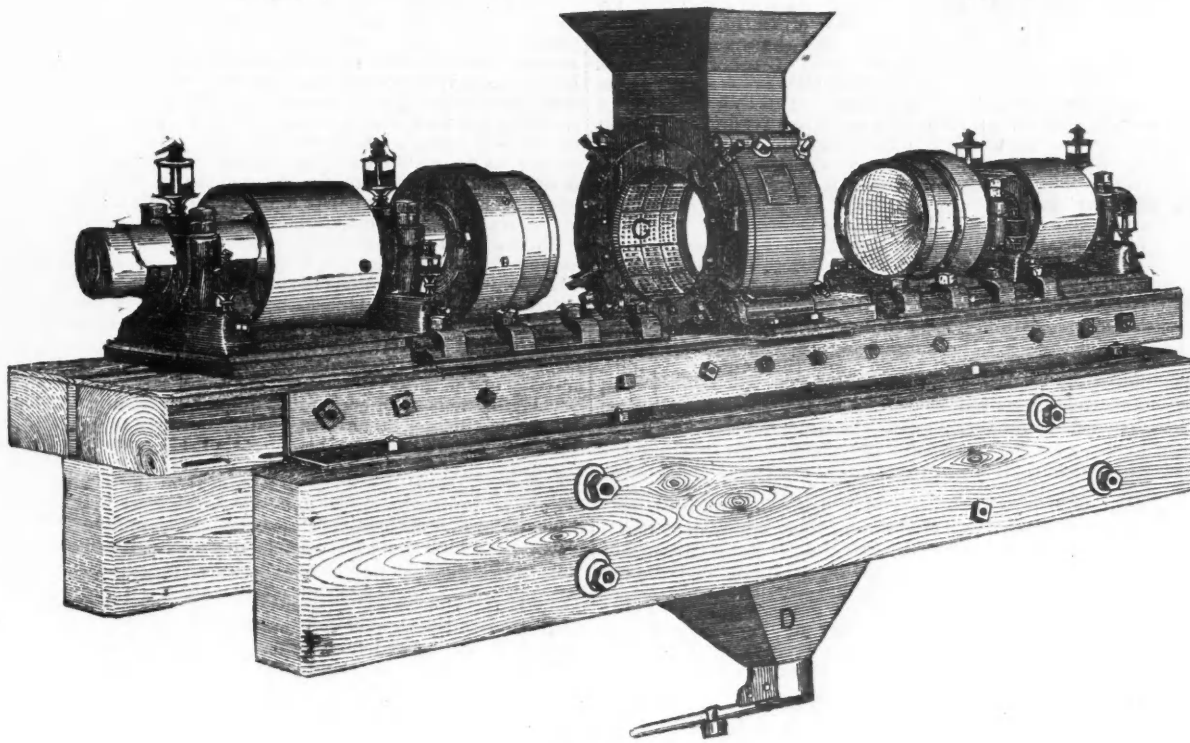


Fig. 2.

ore mines at Reading, a few miles below this city, have a contract with the Tennessee Coal, Iron, and Railroad Company for several hundred thousand tons of red ore, which is shipping to South Pittsburg at the rate of 500 tons daily. The Pratt Coal and Iron Company is busy constructing a branch road 1½ miles long to its new opening, called the Laura slope. It expects to be ready to ship coal inside of sixty days from this opening. Gas has been discovered on the property of this company in the bed of Village Creek, and from present indications in large volume.

BIRMINGHAM, ALA.

C. M. WEISS.

PLATINUM IN RUSSIA.—The platinum diggings of Russia are near Bogoslovsk, Miask, Newjan-k, and Nischn-i Tagilsk, in the Ural Mountains. They were discovered in 1824; and at six places in 1868, 1869, and 1870—from 494,000, 367,000, and 263,000 tons of sand, 6675, 7770, and 6455 pounds of raw platinum were obtained respectively. The metal contains always some other substances; thus Le Play found, in a sample from Nischn-i Tagilsk, 75.1 platinum, 1.1 palladium, 3.5 rhodium, 2.6 iridium, .6 osmiridium, 2.3 osmium, .4 gold, 1 copper, and 8.1 iron. The raw metal is almost entirely sold to England and Paris, at a price of about \$14 per pound of pure metal. It is there refined before it can be worked up into manufactured articles.

is only occasionally surveyed along a horizontal line; consequently, unless the vein be vertical, the side-lines (and also the central line) of the claim will not truly indicate the course of the fissure as it cuts an imaginary horizontal plane. For this reason, individual claims can not be brought as evidence of the validity of this position. Lest it may be thought that my premises are not well taken, I may remark that I have determined these courses in several instances upon the ground by horizontal sights, from point to point, over long distances along the outcrops of well-defined veins, so that I am not dependent on mere loose compilations for my illustrations.

The vertical free-gold bearing parent fissure of this area, using the term in a tentative sense, extends from Red Peak, crossing the divide near the head of Dry Gulch, passing a little north of Gladstone, through the head of the North Fork of Eureka Creek, nearly along the divide between that and Picayune Gulch, crossing the Animas River between Picayune and Burns's gulches, and thence along the ridge between American Basin and the minor sources of Cottonwood Creek in Hinsdale County. After passing Handie's Peak, this course prolonged would cross Lake Fork of the Gunnison and the Lake City wagon-road between Burrows's Park and Sherman in a fold of the underlying metamorphic rocks. In another place, I will recur to this fact, which is only one of many evidences that the great central fissures are intimately connected with the pre-volcanic history of this region.

As before remarked, bismuth is more or less abundant in certain localities in the arsenical zone, and sometimes there to the exclusion of arsenic itself. It is also reported from other sections outside of what I here designate as the bismuth zone proper. Since the discovery of bismuth ores rich in silver in this zone, it has become customary for miners in various localities to use the term indiscriminately for all minerals that have any resemblance to bismuth, or which either do carry, or are supposed to carry, much silver. The term "gray copper" is also used quite as loosely here, and no dependence can be placed upon the names as they are applied in common parlance or in newspaper reports of mining developments. But, while it might be difficult to defend this classification minutely, it is nevertheless true that the several ores of bismuth are more wide-spread and, it might be said, more congenially associated from a mineralogical point of view, in this district, than in other sections. Again, this is the only area in which I have observed the bismuth compounds dissociated, as a rule, from the ores of other metals, and existing, as they commonly do here, in quite separate streaks in the veins. In the Old Lout, Yankee Girl, and other mines within the "arsenical zone," as well as in such cases as have been brought to my attention in the "antimonial zone," it is almost impossible to obtain metallic bismuth, as the result of a single smelting, without a considerable admixture of other metals. In the Old Lout ore, the reduced button is quite malleable from the presence of lead, and in the antimonial zone the bismuth ores yield dull buttons. The metal produced directly from the ores of the "bismuth zone" is remarkably fine, and usually requires but little after-treatment, except to eliminate the contained silver.

Near the Red Peak crater, in the region about the apexes of the zones, there is more liability to complex composition, and, as a consequence, arsenic, tellurium, etc., are occasionally encountered, particularly near the borders of the belt. Dr. Koenig, of Philadelphia, described the mineral alaskaites (containing arsenic) from the Alaska mine at the head of Poughkeepsie Gulch, and I have had strong tellurium reactions from certain portions of the neighboring Adelphi vein. The more clearly the fissures give evidence of the former existence of hot springs, the greater will be the departures in detail from the typical minerals; hence we must be prepared for such apparent exceptions as we find near the central area. Passing eastward along the zone, these discrepancies gradually disappear, and the normal features stand out boldly. But it will be found that the bismuth ores are not specially characteristic of the axial line of the zone. Along this path, free gold is more than usually abundant, and the bismuth-bearing veins are mostly in parallel fissures at a little distance upon each side, and almost invariably their pitch is considerably less than vertical. This peculiarity is even more marked in those veins of other zones that carry bismuth minerals, particularly so in the Old Lout and Yankee Girl. In these instances, much local modification through the agency of hot springs is quite evident, and this fact must be given great weight in comparing these veins with the typical bismuth series, which are usually not examples of mere surface action, as are the exceptions just cited. It is also a fact that the bismuth minerals usually occur near the hanging-walls of the veins.

Another feature of this zone, which I have not observed to such a marked extent in other districts, is the semi-banded character, so to speak. Von Cotta (*Treatise on Ore-Deposits*, Frederick Prime, Jr., 1869, page 10, *et seq.*) divides combed or banded veins into three groups, according to the mode of arrangement of the separate streaks. These are (1) those with "simple symmetry," which we may term symmetrical veins; (2) those in which there is a "symmetrical repetition (or self-repeating symmetry) of the layers," to which we may give the name of complex veins; and (3) such as are apparently unsymmetrical in the arrangement of the layers, but are really what might be styled compound veins, being made up of two or more veins within the same fissure. To these I am compelled to add a fourth class, to include those veins in which the successive layers have been deposited upon only one side of the fissure, as it were, so that what represents the center of a symmetrical vein becomes the hanging-wall of what I propose to denominate a unilateral vein. These unilateral veins do not all agree in their component parts, and many of them carry but one or two bands. It is not necessary or convenient to discuss here all the interesting conclusions that are deducible from the facts, regarding the origin and the history of the ore-deposits of this zone. It is enough to give the general statement that is to follow. My studies show that the order of deposition of the mineral bands has been almost invariably the same, and, practically, as given below, beginning with the earliest formed layer, the one upon the foot-wall:

1. Quartz, bearing free gold, gradually running into
2. Pyrite in quartz, often with little or no gangue also.
3. Bornite or chalcopyrite, usually between thin layers of white quartz (barren).
4. Galenite, sometimes with sphalerite.
5. Bismuthinite and its allies, commonly in flakes or plates irregularly dispersed through white or bluish quartz.

In the axial line of the zone, as a rule, and occasionally in parallel veins, there is little more than the first band, and it is worthy of note that this same peculiarity is characteristic of the opposite zone (No. 5). The great free gold belts lie principally in these two zones, and in Nos. 3 and 6. Pyrite occurs in some veins without any of the other bands, in which case the streak is usually very wide, and nearly free from gangue. In other veins of the belt, there is a well-defined symmetry upon each side of a crevice, and such cases are not always as simple as I have just indicated. There seems to be sufficient evidence to warrant the conclusion that many of this latter class of pyritous veins have been altered subsequently to the original deposition, and during later epochs of vein-formation; for we occasionally find bornite, galenite, or bismuthinite mingled with the pyrite in these symmetrically filled fissures. Again, it is not uncommon to observe symmetrically banded veins, in which quartz, pyrite, bornite (or chalcopyrite), and (more rarely) galenite appear in separate well-marked streaks, or those in which the same structure exists, with some of the earlier mineral members lacking. But I can not now recall an instance of the occurrence of bismuthinite without one or more of the other minerals of the veins, and it is almost invariably, if not always, found in unilateral veins. These facts are intensely interesting, but their teachings can not be enlarged upon in this place. I infer

from them, and many similar evidences, that the veins of the bismuth belt have been filled in five successive epochs, characterized by deposits, as above, and that the earliest fissures were filled by igneous injections of quartz, bearing free gold. Later, side fissures were produced, which were wholly or partly filled from great depths by sublimation or precipitation from hot saturated aqueous solutions. My own belief at present is, that precipitation by cooling (or by crystallization from a liquid) was more common, especially in portions of the fissures inclined much less than 90 degrees. This method has, I judge, been the cause of the unilateral veins. In vertical fissures open after the igneous period, symmetrical veins have probably been formed by sublimation. We shall, then, recognize three distinct periods of vein-growth in this region, which may be conveniently designated as follows:

- I. PRIMARY, ERUPTIVE, or AURIFEROUS.
- II. SECONDARY, VAPOROUS, or Period of Sublimation.
- III. TERNARY, THERM-AQUEOUS, or Period of Infiltration.

Accessory metallic minerals requiring special notice are not abundant, though one or two are quite characteristic of this zone. Molybdenite is prevalent in Eureka Gulch, in several claims not yet fully developed, particularly near the junction of the north and south forks. Nickel and cobalt (?) have not yet been suspected in workable quantity; but I have occasionally detected the former in the bismuth ores, notably in the product from the Byron and the J. R. McKinnie lodes near Eureka. The Ben Franklin and the Hidden Hand mines carry the same quantity of ore, and are probably more or less charged with this metal, but I have never met with enough in any ore to cause any difficulty in cupellation.

Free gold, invisible, and often in flakes and nuggets, occurs abundantly in the Samson and neighboring veins, and in the vein that crosses the Sunnyside extension, following about the course of the No Name, which is also auriferous. The line of the main vent passes thence along Pica-yune Gulch, through the Scotia, Golden Fleece, and other mines, continuing through a series of undeveloped claims west and east of the Animas River, thence along the highest ridges into Hinsdale County.

The topography of this zone, and, in fact, of the whole territory we are considering, is very closely related to the structure I am gradually elucidating in these papers. But more of this hereafter.

Gold is not confined to the main igneous veins, but it occurs similarly in others that bear evidence of aqueous origin to a large extent. But I believe it is not usually found outside of the quartz or the pyrite, except in cases where there has been much apparent alterative action in the veins. Though it is difficult to conceive of an igneous band forming along one side only of a highly inclined fissure, I do not doubt the plutonic character of even the gold quartz seams of many veins that are mainly filled by bands of undoubted aqueous origin. This feature may, however, be readily explained by the supposition that the original vent was filled by the igneous stream, but that the effect of the injection upon the adjacent rock was such as to produce a new line of escape for the subsequent vapors, which would, perhaps, corrode the wall to such a degree as to widen the gap still more. I have observed that, in very many veins of this character, the gangue is different from the usual run of the veins, and that barite and calcite (with salts of alumina, strontia, magnesia, etc.) are most abundant in just the cases referred to.

Evidences of the former existence of hot springs are quite prominent along a line that passes south of the axis, crossing Cement Creek below Gladstone and the Animas River below Eureka, at which points the variegated belt of sintered deposits is well exposed. These must be regarded as the relics of the latest epoch of the Ternary Period; for it can not be doubted that the veins were mostly formed by such agencies on a very large scale. The remnants now visible are only what is left of a former activity of the most stupendous character.

The gangue is most commonly quartz or a silicate, rhodonite (manganese bi-silicate), tephroite (manganese mono-silicate), and knebelite (iron-manganese silicate) being rather abundant. Talc often forms a "gouge," and calcite, barite, etc., are characteristic of special localities. Aragonite (orthorhombic) is more prevalent than calcite, however. Fluorite is prominent in one vein in the South Fork of Eureka Gulch, where it occurs in magnificent crystals, variously colored. The magnesian silicates, of which there is a variety in some sections, are rather less abundant in this zone, and, as might be expected, they are most commonly associated with those gangue minerals (as barite, aragonite, etc.) which occur in the veins with altered wall-rock. The country-rock of the bismuth zone at the surface is usually one of the upper layers of Hayden's "trachyte No. 4," which contains chrysolite (olivine) in thin seams. The feldspar is triclinic (anorthite) and the gangue minerals of the veins are, almost without exception, orthorhombic. Excepting galenite, pyrite, etc., the ores are also orthorhombic.

It is commonly remarked by many who take but superficial views of nature that the free gold discoveries in this region have been usually made "above timber-line." This is true, to a great extent, but there is a very simple reason for it, which the geologist would not fail to discern after a study of the subject. The fact is, as before stated, that the free gold veins are of presumably igneous origin and they are consequently tougher than the later formed veins of the Secondary and Ternary periods. As a result, the former now stand out more boldly than the latter, forming the highest ridges everywhere, which, in our region, are invariably above the timber-line. In most cases, the claims are necessarily worked at this altitude, but we may expect to find the gold continuing to great depths, unless the fissure-walls below are of a character not now suspected. I am aware of the existence of several well-marked apparent exceptions to the rule here set forth (at the Sunnyside Extension and some adjoining mines), but they are in reality the very examples I should have to use as illustrations of the truth of what is predicated above. The rich gold ore of the Sunnyside Extension comes from a cross-vein of different character from the vein on which the claim is located. This cross-vein is in the axial line of the bismuth belt, and has only the one quartz band, while the Sunnyside Extension proper pursues another course and is undoubtedly of later date. At the same time, there is not a little gold in portions of this more recent vein in the deeper workings.

To summarize, the following general principles may be of advantage to investors and prospectors:

1. Free gold in quartz is to be found near the axis of the belt in vertical veins, with usually no other minerals in notable amount.
2. Those pyritous streaks that are most closely connected with the

free gold veins are most likely to carry workable quantities of this metal.

3. Veins with a central crevice (symmetrical) must be judged individually.

4. Unilateral veins are in this district most valuable when the bismuth streak is prominent.

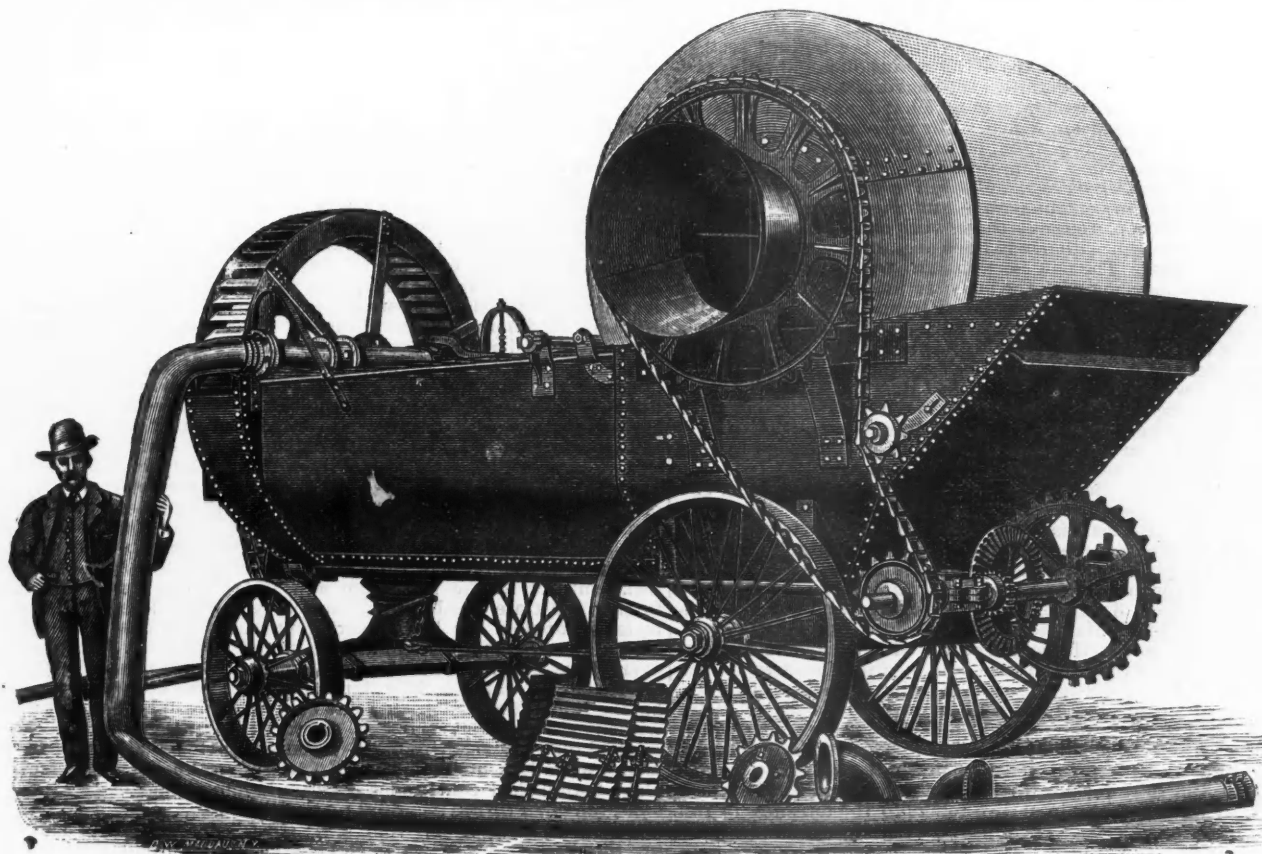
THE BENNETT AMALGAMATOR.

We show, in the accompanying illustration, a machine that is the outgrowth of many years of trials and experimenting, and which is primarily intended to treat auriferous sands and gravels, especially where water is scarce, but is designed also to work ordinary gold sands and the crushed rock from gold stamp-mills. It consists of a steel tank 17 feet long, mounted on wheels of the pattern usual with portable engines. The tank is 40 inches deep and 4 feet wide, the bottom having a cross-section of the shape of the letter W, thus forming two V-shaped longitudinal valleys. As will be seen, one end of the tank is sloped at an angle of 45 degrees, while the other is connected with a small semi-circular tailings-tank by means of a large triangular opening from each of the valleys. Mounted near the tailings-wheel will be seen a water-pipe, from which two branches descend, and which are carried at some distance from the bottom of the valleys to the other end of the tank. From these longitudinal pipes are suspended a series of smaller pipes, at the end of which are orifices turning upward. A number of these small pipes or jets are shown detailed in our drawing. This entire pipe system is moved backward and forward by simple

THE NORTHEASTERN STEEL COMPANY'S WORKS AND THEIR PRODUCTS.*

By Arthur Cooper, Middlesborough.

Owing to the amount of matter that has already been published on modern steel-works, it is not the intention of the writer of this paper to take up the time of the Institute with more than a general description of the works in question, particularly as most of the members have so recently visited them; but as a large portion of the product of the works, namely, the soft qualities of steel or ingot iron, is a comparatively new material, only recently introduced to consumers in this country, he proposes, with the indulgence of the members, to describe fully these several qualities, with the purposes for which they are already used, and, under certain conditions, may be used with advantage; and he trusts that in any discussion that may follow, some information for the general good may result. The erection of the Northeastern Steel Company's works was commenced in November, 1881, and was completed in June, 1883. The works are situated on the south bank of the river Tees, in what is generally known as the iron-making district, and they have access to several groups of blast-furnaces, from all of which supplies of metal in its molten state can be readily obtained. They are specially designed to suit the requirements of the Thomas-Gilchrist or basic process, for the manufacture of steel from Cleveland and other phosphoric irons; and although they are equally well adapted for the manufacture of hematite steel, up to the present time no other steel than basic has been produced. The Bessemer converting plant consists of four 10-ton converters, placed in a line



THE BENNETT AMALGAMATOR.

mechanical means, the main pipe being suspended as shown. The whole submerged inner surface of the tank is covered with rifled amalgam plates. At one end of the tank, is mounted the large double screen so prominent in the drawing. The inner screen is perforated sheet steel, an Archimedes screen being arranged within it to gradually convey the unscreened boulders to the discharge end. The outer screen is steel-wire cloth of suitable mesh, a double Archimedes screw being provided in the space between the two screens to carry the material smaller than the coarse screen and too fine to pass through the wire cloth to the discharge end. The small wheel at the other end is a center-discharge tailings bucket-wheel.

Formerly the engine to drive the machinery was mounted on the truck. It is now independent of the amalgamator, which requires a large steam-pump, a 30 horse-power boiler, and a twelve horse-power engine. The main shaft under the sloping side of the tank drives by link chain the double screen, and, by gearing shown, the machinery at the other end. From this description of the parts of the amalgamator, its operation will be readily understood. The gravel and sand are charged into the screen, and what passes through it is subjected to the action of the currents of water produced by the pulsations of the pump forcing streams through the pipe jets. The gold is brought into frequent contact with the plates, and the tailings are finally discharged at the other end by means of the bucket-wheel. It is claimed that the amalgamator is capable of treating four tons of gravel a minute with 12 miner's inches of water, and that it will handle 200 tons of crushed quartz per twenty-four hours. We are informed by Mr. T. C. Simonton, No. 90 Washington street, Paterson, N. J., who is the agent, that one of these machines is now building in Paterson, where it may be inspected, and that others are now in operation in the West.

in a staging 22 feet above ground-level, each converter shell or casing (made in three sections) being removable from the trunnion ring, after the manner patented by the late Mr. Holley. At one end of the line of converters, stand three cupolas for melting pig-iron, each cupola capable of melting from 1600 to 1700 tons of iron a week. These cupolas have their tapping-holes arranged about 6 feet above the ground-line. The pig-iron, after being melted, is tapped out into a ladle fixed in a four-wheeled carriage; the ladle is afterward lifted by means of a 20-ton hydraulic lift (placed between the cupolas and converters) to the level of the converter stage; it is then moved by a small locomotive to the front of the converter, and its contents tipped in. A second 20-ton lift is placed at the extreme end of the cupola stage, by which entire trucks of pig-iron and coke may be raised for charging directly into the cupolas, the general disposition of the two lifts being such that either may be used for all purposes for which each is specially designed. The converter stage and that from which the pig-iron cupolas are charged are on one level, so that one locomotive does the whole of the shunting, of pig-iron, coke, molten iron, and spiegel, as the cupolas for melting this latter metal are so arranged that they deliver their charges into ladles running on the same stage, which ladles can be moved directly from the cupolas to the converters. The charging of the spiegel cupolas is conducted from a stage 12 feet higher, from which level the lime taken up in light wrought-iron bogies is discharged into the several converters by means of shoots communicating with each. The spiegel, lime, and ferro-manganese are lifted by means of two two-ton hydraulic hoists, at the foot of which are placed the stocks of these materials.

* Read at the Chester Meeting of the Iron and Steel Institute.

Immediately behind the converters, is placed the lining and bottom shop, in which the whole of the lining and bottom-making is conducted; behind this again, are the crushers and mills for crushing and mixing the basic material used for the converter linings; and at one end of the line of crushing machinery, stand the cupolas in which the basic material is prepared. The magnesian limestone, or dolomite, from which this material is produced, is charged into the cupolas with coke, and, after being thoroughly shrunk, is drawn off from the bottom about every two hours, and when cool is picked over by hand, that which is sufficiently calcined being put back into the cupola, while that which is sufficiently shrunk is carried up to a stage running over the crushers, from which, as required, it is fed into the grinding machinery, and mixed with about 10 per cent of boiled tar, to give it the cohesion necessary for the manufacture of the bricks and linings. The bricks, which are used exclusively for lining up the body section or middle portion of the converters, are made by ramming the mixture into wrought-iron boxes or molds with hot rammers. Lids or covers are then secured over the molds. The bricks, thus incased in iron, are placed in ovens and coked for about ten hours, after which they are taken from the molds and are ready for use, having become exceedingly hard and dense under the operation. The plugs or bottoms are rammed of the basic material in a similar way, steel pins being inserted to form the perforations for the blast, while the bottoms are being incased in iron, as the bricks are coked in specially designed stoves, this operation taking about a week: the iron casings being removed, and the pins knocked out, the bottoms are fit for use. The bottom section of the converters and the nose section are likewise rammed with the basic mixture, cast-iron molds being placed inside the casings for this purpose. The coking is effected by making fires inside the molds themselves. The method of changing the converter shell is as follows: As soon as the lining is worn too thin, which is usually the case after it has produced from 500 to 600 tons of steel, the bottom section, containing the plug or bottom, is taken off by means of a hydraulic ram fixed on a carriage, running underneath the converters, on lines of rails communicating with the lining-shop, into which it is quickly drawn by means of a wire rope and a steam winch. The nose section is dealt with in a similar manner. The body portion, or middle section, is afterward lowered from the trunnion-rings by means of an overhead 60-ton steam traveling-crane, placed on a carriage, and taken to the lining-shop in the same way. A 30-ton steam traveling-crane, running the whole length of the lining and bottom-shop, removes these worn-out sections from the carriages and replaces them with newly lined ones, of which several are always kept in readiness. The new sections are put together with the same appliances, commencing with the body section, which is first lifted into the trunnion-ring by means of the 60-ton crane; the joints of the various sections are made with a mixture of the material containing a larger amount of tar, so as to make it quite plastic.

On the front side, and between each pair of converters, is fixed a ladle-crane, by means of which the ladle of finished steel is transferred from the converters to a large casting-crane placed in a 60-foot diameter pit in front of and between the transfer-crane, and in such a position that it may receive the steel from each. The casting-pit is commanded by four ingot-crane for fixing the molds and dealing with the ingots.

On one side of the casting-shop stands the engine-house, containing two pairs of vertical blowing-engines with steam-cylinders, 40 inches diameter; air-cylinders 54 inches diameter, and a stroke of 5 feet; 2 pairs of hydraulic pumping-engines, each having a pair of 26-inch diameter steam-cylinders, and 4 hydraulic cylinders 6 inches diameter with a stroke of 3 feet; 3 blowers for melting pig-iron, each having a capacity of 60 cubic feet per revolution; 3 pairs of boiler feed pumps, and two accumulators, each having 24-inch diameter cylinders and a stroke of 15 feet. In front of the casting-pit is the cogging-mill, with an arrangement of Giers soaking-pits on the right-hand side, and heating-furnaces on the left. The cogging-mill consists of a pair of rolls 36 inches diameter, driven by a pair of geared reversing-engines with 40 inches diameter steam-cylinder and 60-inch stroke. In this mill, ingots are rolled down into slabs for plates and sheets, and into blooms. These slabs or blooms, after being sheared by a powerful shearing-machine, are either carried off to the side of the mill for loading up, or they are taken forward, while still hot, by means of a train of live rollers to the finishing or rail mill to be still further reduced. The finishing-mill consists of two pairs of 28-inch rolls, driven by a pair of direct-acting reversing-engines with steam-cylinders 50 inches diameter and 54-inch stroke. In these rolls, the blooms are reduced to rails, billets, small slabs, bars, etc., of any section, and are then carried forward to the cutting machinery, and finished in the usual way. By the side of the mill, are fixed 15 double-flued boilers, each 28 feet long and 7 feet diameter, working at a pressure of 90 pounds per square inch. Two of the heating-furnaces have each a boiler attached to them of the horizontal type. The steam from the hydraulic pumping-engines, blowers, and feed-pumps is passed through a large water-heater, which heats the feed-water on its way to the boilers to a temperature of about 180 degrees Fahr.

In laying out the works, a production of 2500 tons of ingots and 2000 tons of finished rolled material weekly was contemplated; but owing to the difficulties of starting a new plant on a comparatively new process with, for the most part, untrained men, and the great amount of prejudice found against basic steel among buyers, who could not, in the first instance, be induced to take more than a few tons, in some cases a few cwt., only, to try, the make of ingots during the six months ended December 31st, 1883, only amounted to 24,264 tons, and rolled material 18,957 tons. Since that date, however, progress has been made, not only in getting the material established on the market, but also in the manufacturing departments, as in the six months ended June 30th, 1884, 36,837 tons of ingots and 30,422 tons of good rolled material were produced, while the rate of working since June 30th has been about 47,000 tons of ingots and 40,000 tons of good rolled material per six months. With reference to the various qualities of steel as made by the basic process, some people, while admitting that the process is specially adapted for the manufacture of soft steel, have held that it would never be possible so to control the proportion of carbon as to make rails of uniform quality. It is quite certain that this is not the case, and that rail steel can be produced by this process containing any required amount of carbon, with great uniformity. It is hardly necessary to add that the phosphorus can

be eliminated with great regularity, and that the silicon in basic steel is conspicuous by its absence, as these are now well-known facts.

That the engineers of the various railroad companies who have investigated the question for themselves are satisfied with the rail material, is evidenced by the fact that contracts with two English and two Scotch railroad companies have already been executed; that second contracts are in hand from two of them; and that within the past few months three of the colonial governments, including that of India, have together ordered upward of 10,000 tons of the Northeastern Steel Company's make of basic steel rails. Specimen pieces of the Indian state section as rolled, and a sample showing the fracture, will be found attached to the sleepers that are referred to later on. As regards the manufacture of the various soft qualities of steel or ingot iron in the form of slabs, blooms, and billets, for which, in laying out the works, special arrangements have been made, the particular attention of members is invited to the numerous test-pieces and sample articles manufactured from this material, some of which have been severely punished. That the material from which these several articles are produced can be made with regularity, is borne out by the following figures: In the six months ended December 31st, 1883, there was produced 6051 tons only; in the six months ended June 30th, 1884, there was a demand for 16,292 tons, which has been made and supplied, for the manufacture of sleepers, tin plate, wire, sheets for stamping into hollow ware, and for nails, strips for boiler tubes, sectional steel for ship-building, plates for boilers, rods for rivets and chains, and for other purposes for which best iron has been used.

In the matter of steel sleepers, the Anderston Foundry Company, with whom a large contract for plates has just been completed, reports "that the quality throughout has been most satisfactory; that out of 113,000 plates supplied, only four have failed, and these failures were not due to the steel plates tearing away in bending, as so frequently happened with iron ones, but to hollowness or lamination, which presented itself in the edge of the plate in bending." No doubt this hollowness was due to an insufficient crop being cut from the ingot from which the plates were made. A complete sleeper furnished by the Anderston Foundry Company is shown, together with a half one as tested by the inspecting engineer to prove the quality. Some stampings, rough from the press, 5½ inches and 8½ inches diameter by 10½ inches deep, are also exhibited. These were made by the Anglo-American Tin Stamping Company, of Stourport, from sheets rolled from the Northeastern Company's blooms by Messrs. E. P. & W. Baldwin, of that town, by whom these specimens were supplied; they will show what the material is capable of standing cold. Large quantities of blooms have been delivered for this purpose, as well as for tin plates, wire, strips for nails, door and window hinges, and for tubes, of which latter articles Messrs. James Eadie & Sons, of Glasgow, contribute some interesting specimens for boilers, some flanged and drifted, others flattened out and doubled over cold.

With respect to the slightly harder quality of steel as now used for ship-building, that is, a steel having a tensile strain of from 27 to 31 tons per square inch, the metal as made by the Northeastern Steel Company for this purpose was exhaustively tested and sanctioned by Lloyd's for use in ships to be classed in their register in the early part of the year, and a considerable quantity of materials, principally in the form of angles and tees, has already been supplied for this purpose. Specimens of angles bent cold, and a piece of a bulb-tee 12 inches deep and 6½ inches across the flange, rolled by Messrs. Dorman, Long & Co., are exhibited, this latter representing a large contract which the above-named firm is executing at the present time from basic steel for the French government, subject to the inspection and tests of the Bureau Veritas. To further illustrate the bending, stretching, and welding qualities of the metal as supplied for boiler-making purposes, various other specimens are produced, among which will be found a piece of ¾ths plate folded over twice cold; a disk of steel 3½ inches diameter, and ¾ths thick, in the center of which a hole 1½ths diameter has been drilled, the hole having been afterward drifted out cold until it was 3 inches diameter without showing any signs of fracture; a further disk of the same original dimensions, drifted till it burst, gave a diameter of hole of 3½ inches when fracture took place; a pair of steel bowls, made from ¾ths plate, both dished cold under a steam-hammer, one black as it left the tools, the other turned up bright; a Galloway tube, welded and flanged by Messrs. Fox, Head & Co. from basic steel, and samples of bars welded together, punched with a 1½-inch hole through the weld, then drifted out to 1½-inch diameter, and afterward bent cold in the line of the weld.

In addition to the above, there will be found some specimens of the softest quality produced, known as homogeneous iron, such as is being supplied for rivets, chains, and for purposes for which best iron has hitherto been used. This material contains, by analysis, 99.6 per cent of metallic iron, and in the form of the rod give a breaking strain of about 26 tons per square inch, with an elongation of from 25 to 30 per cent. With further reference to the ordinary soft quality now used for sleepers, tin plates, stamping sheets and wire, in order to determine the maximum and minimum limits of strain between which this material could be regularly produced at the cheapest cost, on August 23d, a sample bloom was taken from twelve consecutive blows which had been made in the ordinary course the day before for tin plates. These blooms were rolled down into plates 11-32-inch thick, and strips were taken from each plate and tested for tensile strain, with the following results:

Blow No.	Breaking strain.	Elongation. Per cent.	Reduction of area. Per cent.
835	26.86	29	52.4
836	28.34	23	55.3
837	26.70	28	49.7
838	26.20	30	55.4
839	26.86	28	48.2
840	23.53	28	57.0
841	25.94	29	54.6
842	27.53	26	51.9
843	27.28	28	51.0
844	23.92	29	59.3
845	25.32	26	54.5
846	27.99	28	45.9

These results show that the tensile strain ranges between 23.53 tons and 28.34 tons, and the elongation between 23 per cent and 30 per cent. Strips from each blow were also submitted to the quenching tests as applied by Lloyd's, and all stood. The whole of these test pieces are pro-

duced for inspection. From the above figures, it is quite certain that, by the basic process, a low steel or ingot iron can be produced regularly, having a tensile strength that would not fall below 23 tons, or rise above 31 tons at the very outside, with an elongation of 20 per cent and upward. It is likewise quite certain that this material could be made at a very much lower cost than the 27 to 31 ton steel used at the present time for ship-building, as with the range of 8 tons there would be no necessity for the steel-maker to concern himself about tests during the process, the pig being taken from the blast-furnaces molten, the ingots hot from the casting-pit, and as far as practicable rolled straight off into the finished product, as in the case of rails, saving heat, waste, time, and labor, amounting in all to a very considerable item per ton on the finished plate or angle.

Objections to this large range of strengths on the score of the difficulty of keeping the steels of the various strains separate, will fall to the ground if, in designing the ship, the whole of the material be treated as capable of standing 23 tons only; for it is not easy to see how a small portion of the plates and angles in a ship that have a tensile strain of 23 tons can be injuriously affected by reason of the remaining ones being capable of carrying up to 8 tons more before they break. As Mr. John pointed out, in referring to this same question in his admirable paper read before the Institute at its last meeting, the iron now used frequently fails at a less strain than 20 tons per square inch. There is no doubt that, with the material above described, with a 10 per cent reduction of scantling from iron, a very much better ship than the present iron one could be made, and one which would be quite equal to the steel ship in its capacity for standing the striking on rocks, from which cause so many iron ships have gone to the bottom, while by reason of the increased scantlings over steel greater rigidity might be reasonably expected; and in point of cost, there is every reason to believe that ingot-iron ships would compare very favorably with those of the iron ships now building. There is also little doubt that for girders, bridge-building, and like purposes, where the better qualities of iron have hitherto been employed, this ordinary soft quality of steel or ingot iron may be substituted with advantage, offering as it does a material very much more uniform in quality than wrought-iron, and at about the same cost, taking into account the higher breaking strain, and the consequent reduction that can safely be made in the scantlings.

THE COPPER MINES OF COBRE, CUBA.

The mining resources of Cuba have, during the past few years, again attracted a large share of attention, American capital having, for instance, embarked in the Juragua iron mines. Among the interests that have participated in this revival, if it may so be termed, are the famous old mines at Santiago del Prado, better known as the Cobre mines a generation ago. For decades, the product of these mines constituted no mean percentage of the total supply of copper in the world, and the cessation of active operations was only due to a coincidence of unfavorable circumstances. Since there is now a strong movement on foot to reopen these old mines, to which we shall refer in greater detail, their history may be retraced. We are indebted to Mr. Krajewski, M.E., of Messrs. Krajewski & Pesant, of this city, for some interesting reports, one by Diego Lopez de Quintana, dated Santiago de Cuba, January 8th, 1853, and January 13th, 1855, from which we cull the following data:

The Cobre mines are situated at Santiago del Prado, eight miles from the port of Santiago de Cuba, in the eastern part of the Sierra Maestra. Near the village of Cobre, and south of it, is the low hill of the Santuario de Nuestra Señora de la Caridad. This hill is formed by argillaceous shales, and has been the scene to an extraordinary extent of igneous action. It is traversed by three veins having a general course of east 15 degrees north, and dipping about 70 degrees south, called the north, the middle, and the south veins. The first named is the most important, reaching in some points a thickness of 36 feet, the average in the lower levels being from 9 to 12 feet. In the upper parts of the vein, oxides and carbonates of copper were found, yielding, especially in the San José mine, from 40 to 50 per cent ore; but in depth they disappeared, and copper and iron pyrites, with quartz as the chief gangue, and a little calc-spar, took their place. The mines were discovered in the sixteenth century by Fernando Nufez Lobo, and until 1716 they were worked by the crown, when they were turned over to tributors, who in time abandoned them, there being little temptation to develop them while Mexico, Chili, and Peru were pouring out their treasures of the precious metals. They lay idle for about a century, until the numerous pilgrims to the shrine of Nuestra Señora de la Caridad, located on the richest part of the deposit, called attention to old workings. In the beginning of the year 1830, capitalists began the search for the vein, and, after they had found it, an additional location was made by Don Joaquin de Arrieta, which mine was later consolidated with that of the former company. At that time, England was passing through one of its periods of mining fever, and the mines were taken over by the consolidated company with a capital of 12,000 £40 shares. Its success led to the formation of a second English company, the Santiago Company, with a capital of £70,000 in £10 shares. A third—Spanish—company, called the San José, was the outgrowth of an early partnership of Don Cipriano Casamadrid and Don José Oñate. A number of other mines were opened, but none of them ever amounted to much. In 1853, the "Consolidada" Company had reached a depth of 853 Spanish feet in the London mine, 925 feet in the Ysabelita mine, 853 feet in the Santuario mine; while the Santiago Company had got down to 433 feet in the San Joaquin mine, 341 in the Perseverancia, 302 feet in the Angelita, and 656 feet in the San Andres mine; and the San José Company had developed the San Juan mine to a depth of 792 feet. The three companies worked on the north vein, until the Santiago, in following the ore in depth, got its vertical side-lines, and, after a serious lawsuit with the Consolidated Company, transferred its work to another vein opening in the Hermitaño mine. An American company was established about 1852 to work the dumps of the other mines by concentration, being called the New York Ore Dressing Company. It ultimately collapsed by reason of the refusal of the other mines to deliver to it the low-grade material. The ore shipped by the mines carried from 10 to 24 per cent of copper. Some

cement copper was also made by precipitating the copper contained in the mine-waters with scrap-iron. From 1843 to 1847, 154,517 Spanish tons of ore were exported; in 1847, the quantity was 26,220 tons; in 1848, 32,733 tons; in 1849, 30,592 tons; in 1850, 26,432 tons; in 1851, 23,752 tons; in 1852, 17,116 tons; in 1853, 16,963 tons; in 1855, 17,493 tons; in 1856, 17,024 tons; in 1857, 17,365 tons; in 1858, 16,160 tons; and in 1859, 13,889 tons. From 1830 to 1854, the total exports of ore were estimated at 426,890 tons, carrying on an average 18 per cent of copper.

This decline in the output of the Cobre mines was due primarily to the withdrawal of a good many of the slaves during the years 1850 to 1855, which the attempted importation of coolies did not overcome; to the appearance of cholera; to the growing depth of the mines; and the increased cost of pumping. A fact that also weighed heavily on the mines was, that the railroad connecting them with Santiago de Cuba was in the hands of a separate organization, which levied an oppressive toll on shipments. The revolutionary troubles of later years caused a final practical cessation of operations, the works being destroyed by fire, and the mines allowed to fill with water. For many years, only small quantities of precipitate have been obtained from the liquors flowing from the old dumps.

The railroad, though having very heavy grades, was originally built in the most substantial manner, and was a highly prosperous enterprise, yielding in twenty-five years, on a capital of \$500,000, dividends aggregating \$2,379,915, not counting \$56,582 due it from the "Consolidada" company for freights for the year 1867. This mining company has been in liquidation for a number of years, and finally accepted the offer of a release in consideration of delivering its mining property to the railroad. During the last few years, efforts have been made by outsiders to claim the mines, and to meet these, the railroad company entered and obtained a claim covering both the Consolidada and the San José mines, with the consent of the representatives of the latter. It thus secured control of the mines, and began the work of reorganization by overhauling the railroad, changing its heavy grade from 4 to 2½ per cent, putting up iron bridges, and shipping to Cuba a 23-ton locomotive, through Messrs. Krajewski & Pesant, of No. 25 Broadway, this city, their agents. The financial and commercial crisis in Cuba has had the effect, however, of retarding the work recently, the majority of those interested being Cuban capitalists, and an effort is now making to obtain funds in this country to purchase the necessary machinery to unwater and reopen the mines.

The first step would be to pump out the mines, and here an important point is made. For thirteen years, the acid water has been standing in the mine, and has undoubtedly dissolved out a good deal of copper from the old stopes, etc. An assay of the upper layers of water, made by Professor They, showed it to contain 0.994 gram of sulphate of copper, or 0.395 gram of metallic copper per liter, or 1000 grams. As the denser liquors have undoubtedly settled to the bottom, it is reasonable to infer that this mine-water will be much richer in depth. Besides this, the Consolidada Company, which had precipitating-tanks in the lower levels, had in them from 600 to 800 tons of scrap-iron, which must have since been converted into a corresponding quantity of copper; and similarly the rest of the iron material in the mine must have been consumed in precipitating a corresponding quantity of metal. Its recovery will largely offset the cost of pumping, which is also much cheaper than it was formerly, it being possible to deliver coal at the mines for \$8 a ton. The old companies had two heavy Cornish pumps, the Handy and the Richard; but the necessary repairs would require their shipment to the United States, so that it will be cheaper to put in a new pumping plant. With relatively cheap fuel, it would probably be cheaper to smelt the medium-grade ores on the spot for matte, while the low-grade ores and the dump material might be treated by the Rio Tinto process, the applicability of which to the similar New Quebrada ores in Venezuela is now testing.

DEATHS FROM ACCIDENTS IN MINES.—Simonin has contributed to the Paris Société de Statistique a paper showing the comparative deaths arising from accidents in mines in some of the countries of Europe. In the subjoined table, it must be noticed that metal mines have been taken into the calculation, whereas in the others coal only is referred to. Moreover, he found it impossible to obtain uniform statistics, so far as the period of time was concerned, those of France, England, Belgium, and Prussia extending over an average of ten years, while Austria-Hungary was only six. France appears to be the best protected country in respect of safety, and Saxony the worst:

Country.	Number of miners.	Number killed per 1000.
Saxony	15,673	3.39
Prussia	2.39
Belgium	76,097	2.38
England	558,817	2.18
Austria-Hungary	42,133	2.10
France	105,742	2.09

A NEW SALTPETER BED.—To the eastward of Cocha-bamba, in Bolivia, South America, an immense saline deposit has been discovered near the village of Arane. Analyzed by M. Sacc, the ingredients are potassic nitrate, 60.70; borax and traces of salt and water, 50.70; organic matter, 8.60 per cent. On dissolving this mixture in boiling water and cooling it, a plentiful crystallization of pure saltpeter is obtained. The soil on which the bed lies is brown and inodorous when it is dry, but, when moistened, it gives out an odor of carbonate and sulphhydrate of ammonia. M. Sacc has found it composed of incombustible residue, 74.20; borax and salts, 15.50; and organic matter with water and ammoniacal salts, 10.30 per cent. The incombustible residue is formed of a very fine sand, and of phosphate of lime, magnesia, and iron in large proportion. The saltpeter has evidently originated from the oxidation of the ammoniacal salts of the soil in presence of potash and soda produced by the slow decomposition of the schists on which they rest. The potassic nitrate has mounted by capillarity to the surface of the soil, while the deliquescent nitrate of soda has been drawn by the rain toward the dry and warm regions of the coast, where it forms the beds of nitrate of soda actually worked in Chili. As immense quantities of fossil bones are found in the soil around Arane, it is possible that the saltpeter beds there, which are capable of supplying the whole world, are a result of the decomposition of a vast deposit of antediluvian animal remains.

THE MAIDANPEC WET PROCESS FOR THE REDUCTION OF CERTAIN POOR CUPREOUS ORES.*

By Brenton Symons, F.C.S., Assoc. Mem. Inst. C.E.

When some recognized chemical reactions are combined in some sequence of operations to establish a process for the elimination of a metal from its matrix, it is often patented and published to the mining community as a comprehensive method to be used for the reduction of all ores inclosing such metal, and much disappointment has occasionally befallen companies that have been induced to work processes that, in practice, have failed to satisfy the requirements.

The species of cupreous minerals found in large deposits are so rarely of homogeneous structure that the detail of any particular process could not be indiscriminately applied to their reduction; because, although the general principles of most hydro-metallurgical methods for the extraction of copper from ores of low grade possess a generic similitude, it is not the less a fact that difference in composition, cohesion, structure, and other qualities may be of such a character as to determine the failure of a process if insufficiently appreciated.

In all ores of meager percentage, the greatest importance must be attached to thoroughness of extraction, and no treatment should be considered satisfactory, either chemically or commercially, which permitted an undue proportion of the metallic *teneur* to remain in the residues.

In the east of Europe, there are not a few mineral properties that contain large reserves so dissimilar that the ores from each mine treated separately would require a process essentially modified. Such was the case with the diverse ores proceeding from the Maidanpec deposits, Servia, and it was this disparity that led to so many disheartening and expensive experiments ere a method that would include the various oxides and sulphides was arrived at.

For the purpose of this process, all the ores obtained from the Maidanpec mines may be conveniently classed in the two divisions, namely:

A. The oxides and carbonates raised from the deposits mantling around the metamorphic limestone boss of Staritza, which are inclosed either in a ferruginous mud or in a gravelly yet sub-plastic clay. These ores contain from 25 to 30 per cent of water, chiefly combined, and the cupreous mineral is insoluble in water.

B. The sulphides or cupreous mundic of Brankovitz Mountain, which, containing only from 3 to 5 per cent of humidity, are dry, incoherent, and insoluble.

The following analyses were made from dried samples carefully collected from the ores smelted during 1877, and though the copper percentage is now (1882) barely half as much, yet the matrices are essentially the same:

	Staritza oxides.	Brankovitz sulphide.
Copper	5.31	3.450
Iron	25.36	34.600
Arsenic	...	1.600
Gold and silver011
Free sulphuric acid	2.72	...
Carbonic acid	6.50	...
Sulphur	8.70	38.220
Silica	20.45	21.300
Alumina	13.22	...
Magnesia	4.95	...
Lime	4.55	.820
Oxygen	7.70	...
Undetermined and loss	.54	...
	100.00	100.001

The character of the ores raised changes but slightly; those mixed and passed through the process had the average composition indicated below:

Sulphide of copper	1.05
Blue and green carbonates	.30
Red oxide of copper	.85
Oxide of iron (hematite)	9.51
Sulphide of iron (pyrites)	34.39
Free sulphuric acid	1.02
Carbonate of lime	5.74
Silica	18.32
Sulphate of magnesia	4.56
Sulphate of alumina	3.51
Alumina	3.81
Water (humidity and combined)	16.00
Undetermined and loss	.85
Traces of arsenic, silver, etc.	...
	100.00

PARAGENESIS OF ORES.—A consideration of these component parts leads immediately to the inference that the ores have a secondary derivation; thus, the decomposition of the pyrites gave birth to cupric sulphates, which, permeating readily the saturated rocks of the deposits, were partly absorbed by aluminous matter, though mostly precipitated as chersylite, malachite, and cuprite, the latter often altering to native copper.

The degradation of the granulite, rich in feldspar, led to the deposition of extensive beds of lithomarge, and the silica thus liberated became intermingled with the copper ores; while free sulphuric acid attacking the magnesian lime rock and feldspar, led to the formation of some sulphates of magnesia and alumina. There appears then no reason to doubt that the cupric and ferric oxides are the final result of these long-continued reactions.

In the process adopted for the reduction of the ores, reactions of an analogous character take place, though accelerated by artificial means. Those already changed into insoluble oxides are intermixed with the sulphides, the burning of the latter affording sufficient sulphuric acid to sulphatize the former. In this way, both the insoluble oxides and sulphides are easily transformed into a condition suitable for lixiviation and precipitation as arborescent copper, or into a state similar to some large masses of native copper found in the mines.

On account of the gravelly character of the pyrites, aggravated by the clayey nature of the oxides, it was found impossible to roast the ores satisfactorily in open heaps; on this account, much time was dissipated in endeavoring to provide a method of oxidation by drying, crushing, and roasting them in furnaces. Eventually, it was shown by experiments that no such expensive operations were requisite, as the proportion of humidity retained by the mixed ores was just sufficient to admit

of their being pressed into coherent slabs, which, when burnt in large heaps, acquired a loose granular condition specially adapted for lixiviation in the tanks without any preparation whatever.

The experience obtained in the roasting of numerous parcels indicates that oxidation proceeds most favorably in kiln-like heaps, exposed on all sides to the air. It has been observed that the lower the temperature of the ignition, the more perfect is the transmutation into sulphates, and that the larger the roast-heaps, the smaller is the percentage lost in the residues. A high heat is to be avoided, as it induces the formation of basic oxides insoluble in water, a result usually termed "over-roasting."

The external layers of *brquettes* rarely ignite themselves thoroughly, and therefore retain from a half to three quarters per cent of insoluble copper; but the bright red "roast" of the interior is sometimes washed down to an eighth, and is rarely observed to leave more than a quarter per cent in the residues. That this loss proceeded from imperfect oxidation, was rendered apparent by washing samples from each; after which, that from the interior exhibited no trace of undecomposed iron sulphide, while the one collected from the outside left on the vanishing-shovel a quantity of mundic, which accounted for the difference in the soluble percentage, and elucidated the cause of the relatively high *teneur* of the residues after lixiviation.

During lixiviation, it is obviously advantageous to prevent the oxidation of the ferrous sulphates, as the accumulation of hydrated ferric oxide on the surface of the ore would considerably obstruct the descending column of the bath, and prolong the interval allotted for saturation. To aid in accomplishing this, the baths must be maintained at a temperature of about 18 degrees Centigrade (64 degrees Fahr.), and well protected from external currents of air. That this is the degree of heat most conducive to the perfect lixiviation of the ores, the results thus far obtained afford confirmation. When the water used is too cold, numerous concretionary lumps are formed (by the combination of portions of the dry "roast" with water), which are impenetrable to moisture.

MINING.—The very low cupreous value of the enormous reserves, which, after the extraction of the richer masses, still remain in the mines, necessitates the severest economy in the management of labor; consequently, every arrangement has been made to facilitate the "stopping" of the ores and their transport to the works. The ore, easily mined by the pick, is barrowed to the numerous perpendicular "passes," whence it drops into the wagons and is trammed to the depots erected near the entrance of each principal level, where, on sliding down a riddle, all fragments not exceeding a diameter of two inches are permitted to fall through. The "roughs" thus separated amount to a hundredth of the bulk, and, to make them suitable for brick-making, are passed through a Cornish crusher. All those portions of the deposits that, on wet assay, appear to include a per cent and half of copper are "stopped," and transferred to the magazines by the miners, "tributers," who are recompensed for their labors at a fixed price per hundred kilograms (220 pounds English) for the copper contained in the ores that they raise. By this arrangement, the extraction of the ore costs about two shillings per *tonne*. The riddled ore requires no further preparation, but is carted directly to the mixing floor.

MIXING.—The ore falls on to the mixing platform in the ratio of a wagon of oxides to one of sulphides—or by weight from 1250 to 950 pounds. The ores are to a great extent intermingled by falling, but in the shoveling across the platform to the hopper of the brick-machine, they become sufficiently incorporated.

The mineral proceeding from so many stopes will naturally vary somewhat in composition; it is therefore necessary to be certain that a quantity of sulphide equal to the maintenance of proper combustion to the last is present in the compost.

BRICK-MAKING.—The blended ores are fed into the hopper of the machine by a workman, and the compressed slabs, as fast as they are delivered, are removed by a strong lad, who places them on light barrows made for the purpose of wheeling the slabs to the roasting-floors that surround the brick-making machine. Three lads are required for the conveyance, as a thousand slabs weighing five *tonnes* are manufactured hourly.

ROAST-HEAPS.—*Pari passu* with the arrival of the barrows, two men are employed to stack the slabs in alternating diagonal layers, permitting a slight interval to remain between each for draught. The freshly-made bricks weigh about ten pounds each, of which quite a sixth part is water; they are consequently liable to become a little crushed by the superincumbent weight; it is therefore preferable to build the flues, by means of which the stacks are fired, of slabs that have been dried hard. A stack of 300 tons should remain a month before it is ignited, to allow time for partial desiccation; otherwise, the heat developed in the interior portion of the pile would drive so much of the moisture to the surface that it would form with the ore a muddy covering that would impede proper oxidation. To successfully ignite this quantity of ore requires an expenditure of seven tons of dried beechwood, split into fathom lengths.

ROASTING.—When the kiln is well ignited, the progress of the oxidation is slowed and regulated by partially luting the sides with ore "smalls." As on the favorable progress of this portion of the process so entirely depends the solubility of the contained copper, too much attention can not be devoted to watching the roast-heaps.

When, at the expiration of about three months, no more sulphurous fumes arise, the "roast," without any further preparation, is ready for the lixiviating-tanks. Since the outside layer of bricks is always imperfectly burnt, they should be stripped off and deposited alongside; the perfect slabs to be worked in the roast-heap flues, and the fragments to be added to the next kiln. The sulphurous acid is allowed to escape.

SAMPLING.—During the roasting, the mixture has acquired a mottled red color, and the slabs, though apparently compact, crumble to pieces while transferring them to the tanks. On the arrival of the trams or barrows at the lixiviating-shed, the tank overseer takes from each a measure of the "roast," and throws it into a box bearing a number corresponding to that of the tank he is engaged in charging, and from the aggregate prepares a sample, by the assay of which its cupreous value is determined.

LIXIVIATION—GENERAL METHOD.

The extraction of the solubles from the oxidized ores is accomplished in wooden cisterns possessing a capacity sufficient to steep a charge of

* Proceedings of the Mining Institute of Cornwall.

thirty hundred weight. They are worked in sets of four deep; two next the charging side for lixiviating the "roast," the third for precipitating the copper, and the last for peroxidating the excess of ferric sulphate. There are three baths circulating constantly through each set of tanks, performing similar cycles in three days. Every charge of ore is washed in such a rotation that each succeeding bath holds in solution less sulphates but more free acid, namely:

BATHS.—(a) A bath that has circulated during seven hours through one batch of ores, and four hours through another, and is now used to wash the newly charged "roast" for eleven hours in order to take up the major part of the sulphates.

(b) A bath that has given a final washing of several hours is now employed four hours in absorbing any sulphates still remaining.

(c) A bath fresh from the regenerating-tank, which, being acid, attacks any cupric oxide to which imperfect roasting may have given existence.

(d) Before the residues are discharged, about 500 liters (110 gallons) of clean water are added to rinse them of cupreous moisture, and to replace the liquid that was absorbed by the dry "roast." In winter, when steam is requisite to maintain the temperature, this quantity is correspondingly reduced.

(e) Each bath, after having percolated during twenty-two hours through three different charges of roasted ore, has become sufficiently saturated with the sulphates of iron and copper, and the liquor is transferred to the No. 3 tank, where the greatest portion of the copper is thrown down in ten hours.

(f) But the liquor, though relieved of its cupreous value, is still loaded with sulphates of iron; it is therefore passed into the No. 4 or regenerating-tank, where the introduction of steam effects the decomposition of the ferric excess, which, transformed to an ocherous oxide, falls speedily to the bottom.

There is some trifling irregularity in the intervals between the various interchanges of the baths, exacted by the necessity for charging all the tanks within the working day: this is of no practical importance.

Prior to the discharge of the residues, they are sampled, and if found to contain too large a proportion of copper, they undergo another day's washing; and this in no way deranges the order of the operations. The assay is made colorimetrically in a few minutes.

FIRST LIXIVIATION.—(a). After twenty-two hours of filtration, the residues, almost exhausted of their cupreous contents, are discharged into the river as valueless; when the workmen commence to run in a fresh charge of "roast." To assist in the distribution of the ores, and to economize time, the bath (which has already been employed in two charges) is pumped on the roasted ore while charging, operations which occupy less than an hour. The leveling of the ore is then completed by hand, and the tank-pump turned into gearing, which, lifting the liquid from the bottom to the surface of the tank, insures an efficient circulation. To accelerate the percolation through the "roast," the pump should draw at a speed sufficient to admit the formation of a vacuum under the false bottom. To obviate as far as possible the deposition of ferric oxide, and to prevent the packing of the ore, only a minimum depth of liquor should be allowed to collect on the surface; also, as the iron sulphates absorb oxygen greedily, the baths and launders should be covered, and the temperature maintained at about 18 degrees Centigrade (64½ degrees Fahr.). The quantity found most convenient for manipulation (with the tanks at present in use) is 1500 kilograms (30 cwts.). This weight demands a bath of 2500 liters (550 gallons), of which the desiccated ores absorb about one fifth. The lixiviation, which begins at seven in the morning, is finished at two in the afternoon; when the bath, having now washed three batches of "roast," is loaded with the sulphates of iron and copper, and is transferred to the precipitating-tanks.

SECOND LIXIVIATION.—(b). The saturated liquor removed, a bath that has given a final washing to the "roast" in No. 2 is run in, and allowed to remain four hours, to collect the remnant of the soluble sulphates. This bath is now restored to No. 2 tank, into which a fresh charge has been introduced.

THIRD LIXIVIATION.—(c). A third lixiviation of ten hours is now given with the bath from No. 4, which, become actively acid by the precipitation of ferric oxide, is in a condition to render soluble the oxides or sulphates which may still remain undissolved.

The liquid is still warm from the effect of the steam turned on; but the two previous baths having removed the soluble sulphates, the heat can not be considered as otherwise than advantageous to this portion of the process.

CLEAN WATER SUPPLEMENT.—(d). Clean water is now run in, to rinse the residues of cupreous moisture, and a quantity is added sufficient to cancel the loss occasioned by the drenching of the dry roast, which amounts to some 500 liters (110 gallons). The clear water is introduced immediately on the removal of the last lixiviation bath, and is allowed to filter through to the false bottom, where it awaits the liquor that is first poured on to a fresh batch of ore, which by this addition preserves its normal bulk and strength. This operation is completed in an hour.

PRECIPITATION OF COPPER.—(e). The baths, after having filtered through three charges of "roast" in the lixiviating department, are transferred (alternately at four in the morning, and two in the afternoon) to the tanks containing cast-iron slabs, where they remain until a Twaddle's tube indicates the descent of a certain proportion of the copper. As the other salts do not readily part with their bases until most of the cupric sulphate has been decomposed, the precipitation is checked before the formation of basic salts, in order to impede the contamination of the precipitate and to avoid loss of iron. And, since the ferric sulphate in solution is extremely sensitive to oxidation, the tanks must be always carefully covered, and the temperature not allowed to exceed 18 degrees Centigrade (64½ degrees Fahr.).

COPPER PRECIPITANT.—Scrap-iron being unattainable in Servia, various substances existing on the property were tried as precipitants (such as spongy iron, charcoal, and limestone), but none of them proving satisfactory in practice, scrap pig (large quantities of which lie around the old iron furnace) was cast into thin slabs, and arranged in the tanks. Though the action of cast-iron must be considered sluggish, there is an absence of the ferrous mud that accompanies precipitation by wrought-iron scrap. As the baths do not require to be freed from copper entirely, this tardy action is of less consequence. To keep the sur-

face of the iron well exposed to the acid action, the slabs are of course frequently scraped. (On the exhaustion of the present stock, pig-iron can be made from the hematites formerly smelted or from roasted pyrites.)

The cement copper was at first barreled and sold in Germany, after having been washed up to 92 per cent; but it was found more satisfactory to run it into ingots, and send it to market as "black copper," where it fetches the price of Chili bars.

IRON PRECIPITANT.—As the rotation of the same lixiviating-baths would be impracticable after some days' operations, on account of the liquors becoming surcharged with salts of iron, it is indispensable to liberate the ferric excess. This is effected in a separate cistern, called the "paint-tank," by means of a steam jet, and the bath after this operation is termed the "regenerated" bath.

REGENERATED BATH.—(f). About two, night and day, the liquor is run into the iron precipitating-tank, and as soon as the end of the pipe is covered, the steam is turned on. By the time the bath is pumped over, the liquor, containing only a small portion of copper, but much iron sulphate, is nearly boiling; and most of the iron kept up by the acid has been oxidized, and thrown down as a hydrated ferric oxide of a bright sienna color ($\text{Fe}_2\text{O}_3 \times 5\text{H}_2\text{O}$). Meanwhile the liquor, which, on entering the tank, was opaque and dark brownish-green, has assumed a light-green color and is perfectly transparent, and contains the sulphuric acid set free by the decomposition of the sulphate.

IRON PAINT.—The iron precipitate is constant in composition and color, and by the application of heat can be converted into red ochre. It is rinsed from the cupreous moisture and removed into convenient lumps to be dried. It is calculated that in treating annually 5000 of the *briquettes*, about a hundred tons of this pigment can be manufactured.

SULPHATE TANK.—The circulation of a bath is continued until a certain sluggishness points to the presence of a mischievous proportion of earthy sulphates, which are principally those of magnesia and alumina.

It should be then run into a special tank, the sulphates crystallized out, and the remaining cupreous liquor returned to the bath circulation; or, if the state of the bath renders it desirable, the copper is precipitated by wrought-iron scrap, and the liquor discharged into the river.

RESIDUES.—The ore-tanks, Nos. 1 and 2, are emptied and charged alternately, morning and evening. The residues are shoveled into a half-funnel, which is placed over an aperture made in the wall of the tank, into which a jet of water is directed; they are thus washed into the stream with little expense. Owing to the experiments undertaken to discover the most perfect system of oxidation, the piles of *briquettes* rarely reached a hundred tons, and the results of the first lixiviations were unsatisfactory. The residues still retained from 0.85 to 0.35 per cent, or, on the average, 0.55 per cent of copper. Later results show a considerable improvement, as a parcel drawn from a well-roasted heap left the tank including only 0.23 per cent of copper. When heaps of several hundred tons are oxidized, and the process worked on a large scale, there is no reason to suppose that the loss will exceed 0.30 per cent on the average, and may be less.

ADVANTAGES OF THE PROCESS.—Given an adequate proportion of sulphide to insure complete ignition, any description of mixed oxides or clayey ores can be pressed into briquettes, and the copper extracted with no other reagents than exist in the ores themselves, and without any expensive preparatory operations. From the nature of the compost, the roasted ores acquire a granular condition, which is peculiarly adapted to render tank manipulation facile.

By the system of bath rotation, the liquor always presents itself in a condition best fitted for the absorption of soluble salts; and goes to the precipitating-tank with a minimum of free acid, or in a state that prevents wasteful consumption of the iron. The copper lost in many processes by the frequent renewal of the bath is saved by this method, which rarely demands the sacrifice of any liquor. The purity of the cement copper is enhanced by arresting precipitation before the formation of basic oxides; and the iron, which the acid thus set free would urge into solution, is spared. The (novel) addition of a "paint-tank," to release the major part of the iron that clogs the liquor, generates an acid bath, which is capable of more or less attacking the cupric oxide insoluble in water alone, and it also liberates a salt that, besides impeding the reactions in every stage of the process, gives rise to a muddy precipitate of copper that it is impossible to cleanse satisfactorily.

MACHINERY REQUISITE.—The plant required for working the process does not demand an outlay of very considerable amount. It comprises a strong dumpy brick-machine (fitted with brass working parts, to minimize the effect of corrosion by the acid action of the ores), which compresses about fifty tons of the ore into coherent ten-pound bricks in a day of ten hours. This machine needs 8 horse-power to work well, and is attached by belting to a 30-foot water-wheel that drives a Cornish crusher. Between the machines and the tank-house, is a large space for roasting the bricks, which are raised in kilns within low stone walls, and are protected from the inclement winter by substantial sheds. The tank-house is closely built and closely boarded. The top of the cisterns being nearly level with the roasting-floors, the roasted ores can be tipped directly into them. A water-wheel of 20-foot diameter has been erected at one end of the house, in order to set in motion the pumps employed to keep the baths in circulation, the shafting for which passes over the beams of the roof.

Immediately adjoining, is a boiler that supplies steam to oxidize the ferric sulphate, and to keep the liquors at a proper temperature during the winter months. The steam piping, which furnishes also the water washing away the residues, hangs from the beams and connects with each tank. The cisterns are 12 feet long and 6 feet wide, and have a depth of nearly 5 feet. They are made of 3-inch oak battens bound firmly together by 1-inch bar-iron, and rest on barks of timber (when attainable, 4-inch pitch-pine should be used in preference). The joints are rendered impervious by the insertion of slips of pine between the planks. They have a false perforated bottom, on which rests for the purpose of filtration a couple of inches of straw, hay, or other cheap material. For transferring the liquors, wooden pumps have been found the least troublesome and the most economical; they are actuated by a rod of wood that can be easily detached or fixed without arresting the machinery. For the treatment of 10,000 tons of mixed ores per annum, forty-eight tanks are necessary.

COST OF PLANT.—With the exception of the tanks (all of which are not yet fixed), the whole of the machinery, buildings, and materials requisite for the reduction of 10,000 tons annually has been supplied. The cost of the plant and direction has been nearly £4000; the wood, stone, and lime were drawn from the company's property.

COST OF TREATMENT.—Nearly a thousand tons of the mixed oxides and sulphides having been reduced by the process, a close estimate of the charges for treatment can be ventured upon. Taking the small quantity of 10,000 tons, to the reduction of which the present machinery is equal, the cost per ton of ore would be nearly as follows:

Mine cost per ton	a.	d.
Transport per ton	2	10
Reduction charges per ton	1	10
Administration—including officers and mechanics	2	0
Total per ton	8	7

(The completion of the tramways from the mines to the works will reduce the cost per ton to seven shillings and sixpence.)

The galleries driven to extract smelting ores have left "stopes" that contain more than 100,000 tons of ore in sight, the cupreous value of which has been shown by numerous assays to average very nearly one and three quarters per cent. Admitting that the process is equal to the separation of a per cent and quarter of the teneur, each ton of copper placed in the market would cost £35. After paying mine dues (1/20th), this would leave a profit on each ton of ore treated of about seven shillings, reckoning Caili bars at £65. The writer (who directed the Maidenpec Copper and Iron-Works for ten years) claims the invention of no new reaction, and the advantages the method may possess are due simply to the admixture of the ores, and to the liberation of the ferric excess which in many processes clogs the bath and produces a muddy precipitate of copper.

THE COST OF MAKING CONNELLSVILLE COKE.

The following sworn statement of the operating expenses of the Redstone Coke-Works, from January 9th to January 15th, 1884, has been printed in connection with the suit of J. M. Schoonmaker versus J. W. Moore and Presley H. Moore in the Court of Common Pleas of Fayette County, Pa.:

372 wagons of coal mined	\$0.40	\$148.80
68 wagons of coal mined	0.35	23.80
931 wagons of coal mined	0.30	279.30
6 men hauling coal, 25 1/2 days	1.80	45.90
1 switchman and superintendent of haulers, 4 days	2.00	8.00
Engineer at upper slope, 1 1/4 days	2.00	3.00
Fireman at upper slope, 1 1/4 days	1.5	2.37
Engineer at lower slope, 6 days	2.00	12.00
Fireman at lower slope, 6 days	1.25	7.50
Pumper at lower slope, 6 days	2.00	12.00
Tipple-man at upper slope, 4 days	1.50	6.00
Tipple-man at lower slope, 4 days	1.65	6.60
1 man on hill pumping, 6 days	1.50	9.00
1 machinist, 5 days	2.00	10.00
Assistant pit boss, 4 days	2.25	9.00
7 roadmen in pit, 27 1/2 days	2.00	55.00
394 ovens drawn	0.60	236.40
370 ovens leveled	0.10	37.00
Car forking		63.80
Loading coke		8.78
Extra labor on yard, 18 days	1.25	22.50
154 piles of ashes lifted	0.02	3.08
50 cars cleaned	0.10	5.00
1 man charging ovens (single-block), 2 1/4 days	2.00	5.00
1 man charging ovens (single-block), 1/2 day	2.00	1.00
1 man charging ovens (double-block), 4 days	2.00	8.00
1 man repairing ovens, 1 day	2.75	2.75
1 man tending mason and doing yard work, 5 days	1.25	6.25
1 man carting, 5 days	1.35	6.75
1 man shifting cars, 4 1/2 days	1.75	8.32
5 men shifting cars, 2 1/2 days	1.50	34.50
1 man shifting cars, 3 1/2 days	1.40	5.25
1 blacksmith, 5 days	2.25	11.25
1 assistant, 5 days	2.00	10.00
Extra work in blacksmith-shop		4.10
1 man making general repairs, 5 days	1.50	7.50
Stable boss, 5 days	1.50	7.50
Teamster, 5 days	1.50	7.50
1 carpenter, 5 days	2.00	10.00
Pit boss, salary		21.00
Superintendent		16.68
Yard boss on new yard		13.00
Yard boss on old yard		12.04
Store clerks		34.00
Office clerks		18.00
Civil engineer		3.33
Feed, etc., for stable		60.00
Expense of running city office		48.33
AIR-SHAFT.		
3 days' labor	\$2.50	7.50
32 days' labor	2.25	72.10
17 days' labor	2.00	34.00
5 days' labor	1.50	7.50
1 day's labor, with team		3.00
Repairs, as per Boyts, Porter & Co.'s bill		25.28
5 kegs H H pit spikes		30.00
Total debit		\$1,555.14

COKE SHIPPED FROM REDSTONE COKE-WORKS FROM JANUARY 9TH, 1884, TO JANUARY 15TH, 1884, INCLUSIVE.

Himrod Furnace, Youngstown, Ohio	696,300
Brier Hill Iron and Coal Company, Brier Hill, Ohio	914,900
St. Louis Ore and Steel Company, East St. Louis, Illinois	341,700
Total	1,952,900, or 976 09 tons
Spearman Iron Company, Sharpsville, Pa.	694,100, or 347 01 tons
A. O. Tintzman, Turtle Creek	27,700, or 13 17 tons
976 09 tons, at 95 cents	\$927.83
347 01 tons, at 92 cents	319.28
13 77 tons, at 90 cents	12.47
Total	\$1,259.38
CREDITS TAKEN FROM ROLL.	
Tenements	\$107.30
Blacksmith	16.47
Stable	5.22
Hauling	12.00
Total credits	\$1,400.37
Net loss	154.77
Total	\$1,555.14

COMPARATIVE VALUE OF CERTAIN FUELS FOR PRODUCING STEAM.*

By C. H. Nettleton.

In the experiments that are the basis of this paper, an attempt has been made to ascertain the comparative value of certain fuels for making steam. The writer has endeavored to select only such fuels as would naturally be used under gas-works boilers in this section of the country.

No claim is made for excellence in the results, as both the type and size of the boiler employed precluded the possibility of obtaining the economy of fuel easily secured in boilers of larger size and different construction.

The boiler in which the experiments were made is of the upright tubular pattern, and of the following dimensions: Diameter, 50 inches; height, 9 feet; contained one hundred 2-inch by 6-foot tubes; and rated at 30 horse-power. It is incased by an 8-inch brick wall with 2-inch air space.

The fuels used were coke (with and without a blower), coke-dust, carbon, screenings from the ash-pan, Lehigh coal, and Lehigh coal-dust. In each experiment, the conditions were, as nearly as possible, identical. The water was measured in a large barrel that held, between certain points, 365 pounds. It was drawn from this barrel and forced into the boiler by means of a Hancock inspirator. While stored in the receiving-barrel, the water had an almost uniform temperature of 71 degrees Fahr.; and on entering the boiler, a temperature of 140 degrees Fabr. Before commencing with each experiment, a fire was made out of the material intended to be used, and allowed to get well under headway. The height of the water in the boiler was noted at the beginning of each experiment, and maintained, as nearly as possible, at the same altitude at the conclusion. The work for which the steam was employed was kept as uniform as possible; and in consequence, the daily quantity of water evaporated was very nearly the same. The boiler was run continuously, and each experiment was either of 48 or 72 hours' duration. The flues and interior of the boiler were kept well cleaned during the progress of the work.

When a blower was employed to assist the natural draught, a grate with a smooth, flat surface, pierced with holes, was used. When the blower was not employed, the ordinary style grate, with bars five eighths of an inch apart, was the sort used. The blower was a No. 3 Sturtevant, of the kind known as the Monogram pattern, and ran at about the rate of 1300 revolutions per minute.

The following table gives the results obtained:

TABLE SHOWING COMPARATIVE VALUE OF CERTAIN FUELS IN PRODUCING STEAM.
Experiments without a Blower.

No.	Material.	Time.	Quantity of fuel.	Water evaporated.	Water evaporated per pound of fuel.
1	Coke	48	2175 lbs. = 56 bu.	16,425 pounds.	7.55 pounds.
2	Coal	48	2380 pound	17,520 "	7.36 "

Experiments with a Blower.

No.	Material.	Time.	Quantity of fuel.	Water evaporated.	Water evaporated per pound of fuel.
3	Coke	72	4058 pounds.	28,105 pounds.	6.92 pounds.
4	Carbon	72	3369 "	26,645 "	7.91 "
5	Breeze	48	2262 lbs. = 39 bu.	12,927 "	5.71 "
	Coke	48	369 pounds.	2,768 "	7.50 "
6	Screenings	48	3047 "	15,760 "	5.17 "
	Coke	48	40 "	300 "	7.50 "
7	Coal-dust	48	1921 "	11,090 "	5.77 "
	Coke	48	614 "	4,605 "	7.50 "

Experiment No. 1.—The coke was quite dry, weighing 38.8 pounds per bushel. It will be noted that it evaporated a trifle more water per pound than did the coal of the second experiment.

Experiment No. 2.—The coal used was a hard Lehigh egg, free from slate and dust.

Experiment No. 3.—The coke used contained some water; the weight per bushel was not ascertained accurately, but approximated to 41 pounds. The cause of the results obtained in this experiment being so much lower than those obtained from coke without a blower was owing to the pressure of the contained water, and the further fact that, during a portion of the time, the furnace-door had to be left open to keep down the pressure of steam.

Experiment No. 4.—The carbon used was the ordinary retort carbon, broken to the size of pieces whose greatest length was about 6 inches. No difficulty was experienced in burning it, and the results obtained would have been much better but for the fact that the furnace-door was kept open part of the time, to prevent an excess of steam pressure.

Experiment No. 5.—The breeze used was the coke-dust left on the floor of the yard after the coke had been forked away. It weighed 58 pounds a bushel. To keep up steam when the clinker was removed, in both this and the following experiments, a quantity of coke had to be consumed. To ascertain the value of the breeze, it has been assumed that each pound of coke so used evaporated 7.5 pounds of water, and that the breeze evaporated the balance.

Experiment No. 6.—The screenings used were obtained from the refuse taken from under the furnace fires. This material was screened and hand-picked, and what was left consisted of small pieces of partially burned coke, with quite a percentage also of small clinker.

Experiment No. 7.—The coal-dust used was obtained from the neighboring coal-yards, and consisted of the screenings from various qualities of anthracite. The screenings are used by the writer on account of the low cost—being delivered for \$1.25 per ton of 2000 pounds.

* A paper read before the Society of Gas Lighting.

The following figures show the value of each sort of fuel per ton of 2000 pounds, the cost of coal being estimated at \$5 :

	Evaporative power per pound.	Value per ton of 2000 pounds.	
Coal.....	7.36	\$5.00	
Coke.....	7.55	5.13	or 9.98 cents per bushel of 38.8 pounds.
Carbon.....	7.91	5.37	
Breeze.....	5.71	3.88	or 11.2 cents per bushel of 58 pounds.
Screenings.....	5.17	3.51	
Coal-dust.....	5.77	3.92	

The experiments above reported show that in evaporating 8000 pounds of water, a saving of from \$1 to \$2 can be gained by the substitution of breeze, screenings, or coal-dust fuels in place of coke or coal.

It has been urged as an argument against the use of a blower that its effect in working is to destroy a boiler in a comparatively short space of time. That the employment of a blower does decrease the life of the fire-box is admitted ; but while that destruction is accomplishing, the writer believes that the saving effected through the use of the cheaper fuels will amount in the aggregate to a far greater sum than the charge to expense account in the shape of repairs.

A 20 horse-power boiler has been operated for nearly thirteen years in the town of Birmingham, Conn., coal and breeze having been used under it as fuel during all that period. The total expense for repairs to that boiler has not exceeded the sum of \$500, and to-day it is in perfectly good condition, and is likely to last for a number of years longer.

The writer trusts that he will be pardoned for calling your attention, at such length, to what may be denominated one of the side issues of the gas-maker's industry ; but he firmly believes that the use of these cheap fuels is one of the small (but nevertheless important) economies in gas manufacture, and, in addition, he has sought to add his experience to that of others—that a pound of coke is worth fully as much as is a pound of coal, when it comes to the test of selecting a material to be used as a fuel for the purposes of steam generation.

A CURIOUS EXPLANATION OF THE POCAHONTAS FIRE-DAMP EXPLOSION.

Through the kindness of a gentleman who has taken a deep interest in the Pocahontas fire-damp explosion and has gathered a good deal of material on the subject, we have been favored with a newspaper clipping from the Wytheville *Despatch*. It contains an article, written by request, by C. R. Boyd. It strongly illustrates how dangerous is a smattering of knowledge, and enriches the literature of the subject with a choice bit of nonsense that, if not instructive, is at least amusing. We quote :

"The supply of fresh air in the mines was dependent on a system of ventilation common in such mines, supplied with vents at intervals and penetrating into the different parts of the mine, nearly horizontally, through which the air was rapidly driven by means of large fans operated by a powerful engine. If there were any shafts connecting with the surface of ground above, it is not known to the writer.

"The explosion which took place may be then ascribed to the impossibility of the system of ventilation to free the dangerous fire-damp, commonly known as the light form of carbureted hydrogen. As long as the outside atmosphere was comparatively dry, the danger of an explosion was materially lessened ; for the air-fans would then only inject dry air, which, besides doing the duty of displacing the air which had become foul from other causes, was taking up some of that dangerous excess of moisture that was combining with the carbon in the finely communicated [sic] particles of coal-dust, always present in large quantities in a mine being worked on so large a scale. But, unfortunately, the weather had been damp for, not weeks only, but months, particularly the days just preceding the disaster. Hence every revolution of the fans only drove into the mines—which were perhaps becoming already wet from the melting of so much snow on the surface and long-continued rains—a constant accession of moisture. Every jar, every blow from pick, or stroke of any kind, and every blast by gunpowder, added to the elements of impending disaster. Every motion of impact of any kind caused the heavily laden [sic] air to give up moisture in its original constituents, and the hydrogen coming into intimate contact with the carbon in finely comminuted particles of coal-dust and with the constituent carbon of gunpowder just after its explosion, in a highly agitated state of atmosphere, produced all of the elements of the terrible explosion much more rapidly than they could be removed.

"Had it been possible to dry the air introduced by the ventilators, the accident would no doubt have been avoided : for, considering even the chance during the progress of mining, of breaking into fissures or reservoirs of confined fire-damp, this powerful engine had no doubt been injecting an almost unmeasurable supply of air—such as it was—which, had it been dry, would have contracted the scope of the explosion, if it had not utterly prevented it.

"And then, in any case, had their [sic] been an air-shaft of sufficient dimensions leading up to the surface, the light gases, which is [sic] the terrible agent of this explosion, would have arisen and have been driven by the force of the ventilators out of the mine as rapidly as they formed. As it was, the dreadful moment arrived when nearly the whole space of the mine must have been loaded to saturation with the dreaded fire-damp—ignited at length by the lamp of some miner in the higher levels, it exploded, almost lifting the mountain from its base."

SALE OF PUBLIC LANDS.—From a statement prepared at the Land-Office showing the disposal of the public lands for the fiscal year ended June 30th, 1884, it appears that the cash sales amounted to 6,817,847 acres, from which were realized \$10,302,532. The original homestead entries included 7,831,509 acres, the final homestead entries 2,945,574 acres, and the timber culture entries 4,084,463 acres. The miscellaneous disposals aggregated 8,600,219 acres, including 8,343,154 acres of railroad lands, for which the sum of \$1,536,410 was received. The aggregate number of acres of land disposed of under all heads, including the final homestead entries, was 26,834,041, and the aggregate receipts were \$11,838,993. This is an increase over the disposals last year of 8,101,137 acres, and of \$1,075,521. Indian lands to the amount of 697,128 acres, which were sold for \$988,137, are not included in the foregoing totals.

SPANISH EXPORT STATISTICS.—For the first six months of the years 1883 and 1884, the Spanish export statistics exhibit the following :

	1884.	1883.
	Tons.	Tons.
Calamine.....	19,463	20,762
Pyrites.....	325,325	307,414
Iron ore.....	2,243,311	2,181,197
Salt.....	166,854	110,628
Quicksilver.....	1,168	446
Copper.....	8,202	10,921
Lead.....	61,291	61,979

The only heavy decline shown is in copper.

THE HENDERSON GAS-FURNACE AND PROCESSES.—A syndicate of iron manufacturers has been formed to make trials of the Henderson gas open-hearth steel-melting furnace and of Henderson's various processes for making soft steel to be used as a substitute for puddled iron, with the view of changing their works to the new processes. The syndicate is composed of the E. & G. Brooke Iron Company, the Reading Iron-Works, the Montour Iron Company, Charles L. Bailey & Co., A. Pardee, Jr., William McIlvain & Sons, John O. Hughes, of Hughes & Patterson, Marshall Brothers & Co., the Old Dominion Iron and Nail-Works, and Charles G. Francklyn. Trials are in progress with the two-ton furnace at Bellefonte, Pennsylvania, which so far have been satisfactory, the waste and fuel being less than have heretofore obtained in other furnaces or processes, with smaller outlay for plant. Labor and repairs are also less than with other kinds of furnaces for a given product. All kinds of pig or scrap-iron or scrap-steel are used.

VALUE OF EXPORTS AND IMPORTS.—The Chief of the Bureau of Statistics in his second monthly statement for the current fiscal year, of the imports and exports of the United States, reports that the excess of the value of exports of merchandise was as follows : August 31st, \$3,561,746 ; two months ended August 31st, \$3,054,597 ; eight months ended August 31st, \$13,810,432 ; twelve months ended August 31st, \$77,174,341. The total values of the imports of merchandise for the twelve months ended August 31st were \$657,832,834, and for the previous twelve months \$707,272,264, a decrease of \$49,439,430. The values of the exports of merchandise during the twelve months ended August 31st, 1884, were \$735,007,175, and during the twelve months ended August 31st, 1883, \$820,818,401, a decrease of \$85,811,226. The exports of gold and silver coin and bullion during the twelve months ended August 31st, 1884, amounted to \$68,789,591, and the imports to \$39,882,721, an excess of exports over imports of \$28,906,870. During the preceding twelve months, the exports of gold and silver amounted to \$26,149,309, and the imports to \$31,797,996, an excess of imports over exports of \$5,648,687.

FURNACE, MILL, AND FACTORY.

Reports from the South state that the iron interest is reviving. The Woodstock (Ala.) Iron Company has just closed a contract for 13,000 tons of car-wheel iron, at \$20.50 a ton. This is the largest order placed in the South since the depression began. Reports from other furnaces indicate increased inquiry for iron.

The Portsmouth (Va.) iron-works were destroyed by an incendiary fire October 3d. The property was fully insured.

The Pennsylvania Steel Company, at a regular meeting held October 1st at Philadelphia, elected the present officers and directors for the ensuing year, as follows : President, S. M. Felton ; Secretary and Treasurer, E. F. Barker ; Superintendent, Luther S. Bent ; Directors, Samuel M. Felton, Edmund Smith, William Matthews, H. H. Houston, Charlemagne Tower, William W. Spackman, and Francis Thompson, of Boston. The full number of men is employed at the company's works, and large orders are filling.

Mallon & Rourke, iron founders, of No. 127 Jane street, New York City, made an assignment October 3d, to Frank E. Fitzgerald, without preferences. The firm was formed in March, 1871, by Edward Mallon and John Rourke. There are two chattel mortgages on their plant for \$12,500, which is due on October 6th. The liabilities are about \$59,000.

H. K. Taylor and E. M. Wilson have been appointed receivers of the Malleable Iron-Works at Youngstown, Ohio. The assets are said to be largely in excess of liabilities.

All of the effects of the St. Louis (Mo.) Malleable Iron Company at St. Louis, which recently made an assignment, have been turned over to the officers of the company by order of the court. Work is to be immediately resumed on large contracts that run until 1886.

An order in the Ottawa (Ontario) Council has been passed allowing steel for shovels and spades, of not less than 11 or more than 18-wire gauge, and costing not less than \$75 per ton of 2240 pounds, to be imported free of duty by manufacturers of shovels and spades for the purpose of manufacture until the next session of Parliament begins.

Capitalists are considering a project of building a \$100,000 nail-mill at Ash-tabula.

The Hamilton Powder-Mills, Cumminsville, Ont., were blown up October 9th. Four men were killed and two wounded.

James Harris & Co., of St. John, New Brunswick, have received the contract for the construction of 300 coal-hoppers for the Intercolonial Railroad.

The Westinghouse Brake Company is running its shops on half-time. A company to be known as the Texarkana (Ark.) Foundry and Machine-Works has been incorporated at that place, with a capital of \$500,000.

The Baldwin Locomotive-Works, of Philadelphia, have just completed an order for 20 freight-engines to go to New South Wales. Orders for heavy freight-engines for the Missouri Pacific and the Wabash, St. Louis & Pacific railroads are in progress.

The Fort Pitt Iron and Steel-Works, Pittsburg, Pa., which have been closed down for the past three months, on account of a lack of orders, have resumed in all the departments, giving employment to several hundred men.

The Board of Managers of the Schuylkill Bridge Company has awarded to the Phoenix Bridge Company, at Phoenixville, Pa., the contract for a new iron bridge, to replace the one over the Schuylkill recently destroyed by fire. The contract price is \$13,500, and the work is to be completed in about five weeks.

The Geddes Iron-Works, at Syracuse, N. Y., have become financially embarrassed, and Charles E. Hubbell has been appointed receiver. Three judgments for \$28,000 were obtained against the concern. The company was an old and well-established one, having been incorporated in 1861, with a capital of \$200,000.

The contract for the building of the Milwaukee, Lake Shore & Western Railroad's ore-docks, at Ashland, Wis., has been let to C. C. Smith, of La Crosse, whose bid was \$185,000, which does not include much of the iron and steel work.

A judgment for \$2362 was recently obtained against John J. Anderson, of No. 115 Broadway, New York City, for steel furnished the Washoe Manufacturing Company on his indorsement, by George Abell, Jr.

The largest locomotives ever built by the Philadelphia & Reading Railroad Company are now in process of construction at the machine-shops, Reading, Pa. The steel boilers and axles rest on wheels that weigh 1900 pounds, each axle weighing 1050 pounds. The engines will be used exclusively for the coal-carrying trade.

Messrs. Copeland & Bacon have received contracts for complete plant of special hoisting machinery to be used in the construction of the new cantilever bridge at St. John's. This firm makes a specialty of hoisting machinery, in all forms, designing the machinery always for the work to be done. It is also busy on hoisting plant for the Haile Gold Mining Company of South Carolina, and has just completed a large plant of ore-washing and hoisting machinery for the Low Moor Iron Company. It is also busy on plans for other new works.

Messrs. Eimer & Amend, manufacturers of chemical apparatus and chemicals, of this city, have again enlarged their establishment for glass-blowing, etching, and grinding in the line of scientific apparatus.

The charcoal shed and part of the furnace shed, together with a large amount of charcoal, were burned October 3d at the Principio (Md.) iron furnaces, belonging to the G. P. Whitaker Company, entailing a loss of about \$10,000.

The Kansas City Smelting and Refining Company is building works for parting doré bars. It will probably use the electrolytic process with the improvements of Dr. Moebius.

The M. C. Bullock Manufacturing Company, of Chicago, is erecting a large pair of hoisting-engines with 10-foot drums, and a plant of air-compressors and rock-drills, for the Spring Valley Coal Company, of Peru, Ill. It has also just recently started two fine installations of Brush electric light at Marinette, Wis., and Menominee, Mich., the latter driven by one of its straight-line engines. It is just filling a large order for shafting, pulleys, and hangers for the Pullman Palace Car Company, making the second large order from it within a year. It has also recently received an order for six of its Sweet's straight-line engines for the new Board of Trade Building in Chicago, securing this order in the face of very sharp competition, on account of the superiority of the engines. It is in receipt of an order from the Straight-Line Engine Company, of Syracuse, N. Y., for a 90-horse-power straight-line engine. This is "carrying coals to Newcastle," to build straight-line engines for the Straight-Line Engine Company. A few days ago, it closed an arrangement with the Gowan Car-Wheel Tool Company which gives the M. C. Bullock Company the sole and exclusive right to manufacture and sell the new car-wheel boring, grinding, and truing machines for the United States. It has completed a hole that was bored for coal at Washington Ill. The hole was bored with one of its diamond drills to a depth of 380 feet before rock was struck. It then bored an additional 93 feet, and came in contact with a vein of coal that in quality and depth can not be excelled in the State, and is similar to the coal now mined at Minonk and Roanoke.

RAILROAD NEWS.

The Waldins Ridge Railroad, a line extending 22 miles from Emory Gap, on the Cincinnati Southern to the coal-fields, was formally opened October 2d.

The Pennsylvania Railroad has given the Baltimore & Ohio Railroad notice that, after the 12th, the latter can not use the Philadelphia, Wilmington & Baltimore and the New York division for its New York freight and passenger business.

The Black Creek Short Line Company has filed articles of incorporation in Alabama to build a railroad from a point five miles north of Birmingham, on the South and North road, to a point three miles east of Birmingham, on the Georgia Pacific road, with privilege of extending in either direction.

A petition has been presented on behalf of the receivers of the Philadelphia & Reading Railroad, asking leave for the appointment of a new trustee of the income mortgage of the railroad company. The vacancy was caused by the death of Edwin M. Lewis, who held that position. Samuel Bell was named for the appointment.

The representatives of all the railroads passing through the coal mining regions of Illinois met at St. Louis, October 8th, and reorganized the coal pool that was dissolved last spring, agreeing to restore rates on October 13th. This action terminates a long fight which, it is said, has cost the roads \$200,000.

A charter has been granted to the Colorado Midland Railroad, which will start from Colorado Springs, thence to Manitou, through Ute Pass to the base of Pike's Peak; thence through the South Park to Alma, Horse Shoe, Iowa and California gulches to Leadville; thence across the range at Half Moon or Lake Creek on to Frying Pan, Glenwood Springs, and the State line. This route is about 155 miles air line from Colorado Springs, and taps the immense timber country around Pike's Peak and the low-grade ores of Fairplay, Alma, etc. Two surveying parties are now on the route; the chief-engineer has been over the line, and expressed the opinion that the road between Aspen and Leadville should be built first to accommodate the increasing freights of this section. The cost is placed at \$2,500,000.

LABOR AND WAGES.

At the Central Labor Union's meeting held in New York City October 5th, the Tin and Sheet-Iron Workers' Union reported that they had sent around to all employers asking them to agree to pay workmen \$3 a day. The greater number of them now pay \$2.50 and \$2.75.

Col. Carroll D. Wright, of the Bureau of Labor Statistics of the State of Massachusetts, and the representatives of corresponding State bureaus, are at present on a tour of investigation of the economic relations of the town of Pullman, Ill., built by the Pullman Car Company. The questions they will endeavor to secure answers to are: Whether the workingman or the capitalist is the better off by the system, and whether it would be advisable to recommend the general adoption of such a system? Colonel Wright has stated that he has visited Saltaire, in England, the model town which Sir Titus Salt instituted, and the village that the Krupp gun manufacturers have established in Germany, and he thinks that Pullman is far superior in point of size and beauty to either one of them.

The reduction of 25 per cent in the rod mill and 10 per cent in other departments of the Cleveland Rolling-Mill, Ohio, has been compromised by making the reduction in the rod mill 20 per cent, and the men returned to work.

A number of canal boatmen at Cumberland, Md., have demanded 80 cents for carrying coal, instead of 60 cents a ton.

The abolition of convict labor in prisons, wherever it conflicts with skilled mechanics, is now urged in St. Louis, Mo., and a set of resolutions to that effect is numerously signed by the inhabitants of that city.

The New Jersey State Labor Congress met in Newark, October 6th. About one hundred delegates were present. Various labor topics were discussed.

The miners and coke-drawers at the Morill and Cambria Coke-Works in the Connellsville region have struck against a proposed reduction of 10 per cent in their wages. The two works employ about 4000 men. The rate of wages paid, which is uniform throughout the region, is 35 cents a wagon for digging coal and 60 cents an oven for drawing coke.

The demand for laborers and mechanics at the Castle Garden Labor Bureau is poor at present. Mechanics fix their wages at the current rates of their particular trade, and day laborers get \$1.25 a day.

The strike among the fourth pool miners is at an end. Reports received in Pittsburgh state that the miners are all at work at the reduction.

Dispatches dated October 9th state that the miners in the Clearfield region are quietly preparing for a strike. There are local suspensions in several districts. John Britt, the district president of the Miners and Laborers' Amal-

gamated Association, and other prominent leaders, are preparing for a strong aggressive movement against the company store system. No interest is taken in the organizations in the anthracite region. The district associations in the Schuylkill regions are disbanded.

A reduction of 10 per cent has been made in the wages of the men employed in the quarries belonging to the Slate Exchange of Lehigh and Northampton counties, Pa.

The proposed reduction of 12½ per cent in the wages of the employés of Oliver Brothers & Phillips, iron manufacturers, has been withdrawn, and work in the mills will be resumed immediately at the old wages.

The employés of the steel-works firm of Benjamin Atha & Co., Newark, New Jersey, numbering some hundred, had their wages reduced 10 per cent October 4th. This is a second reduction of 10 per cent within a year.

The Federation of Trades and Labor Unions, consisting of representatives from the various labor organizations of the United States and Canada, began its sessions at Chicago, Ill., October 7th. The object of this annual assembly is to discuss the questions at issue between capital and labor, and to disseminate such views among the organized working people of the country as will secure recognition for them. The delegates number 50, and they claim to represent nearly 1,000,000 wage-workers. In the reports presented, the statistics for the last four months showed that the strikes numbered in the United States ninety-eight, affecting 53,000 employés. Fifty had been against reduction of wages, and seven for increase of wages.

COAL TRADE NOTES.

CANADA.

PROVINCE OF NOVA SCOTIA.

Two coal-cutting machines, to be employed in the South Slope of the Spring Hill mines, have been purchased by the Cumberland Coal and Railroad Company. The engines to drive the machines have not yet arrived, so it will be some time yet before they can go into operation. A lot of new and large coal cars have lately been acquired by the company.

PROVINCE OF ONTARIO.

The coal producers' committee controlling the Toronto market held a meeting in that city October 5th with the local dealers, at which a reduction in price to \$8 a ton was agreed upon. Among the reasons assigned are undercutting in rates by some local men and overproduction at the mines.

ILLINOIS.

The governor, on September 30th, appointed the following district mine inspectors: Alexander Ronald, of Streator, First District; Thomas Hudson, Galva, Second District; John Rolla, of Streator, Third District; Walter Rutledge, of Alton, Fourth District; and Robert Wining, of Centerville, Fifth District.

The O'Connell Coal Company, at Joliet, has been incorporated with a capital stock of \$10,000. The incorporators are John O'Connell, Erwin E. Wood, and John Carraher.

MARYLAND.

Reports from Lonaconing for the week ended October 2d: Eckhart, full-time. Hoffman, 5½ days. Alleghany, very little. Borden, idle. New Hope, Blaen Avon, and Borden Shaft, half-time. Miller, half a day. Ocean, full-time. Midland, about half-time. Old Coney, 4 days. New Coney, 2½ days. Koonitz, 4½ days. All the Detmold mines worked full-time, but some of the miners were idle, owing to their being ahead of the turn. The Jackson mines were idle almost the entire week; prospects better. Pekin and Potomac, full-time. Swanton, three-quarter time. Puenix, quarter-time. Franklin, half-time. Hampshire, full-time.

MASSACHUSETTS.

Washington L. & C. J. Prescott, coal and wood dealers, No. 301 Harrison avenue and No. 91 Mount Washington avenue, Boston, have been petitioned into insolvency by the receivers of the Philadelphia & Reading Coal and Iron Company.

MEXICO.

Eighty tons of coal a day are extracted from the coal-beds of Salinas, Coahuila, and the miners receive \$1.50 daily. The extent of the district is five hundred leagues square, and it is expected to produce two hundred tons a day by the end of October. The coal is now consumed by the Mexican International Railroad and its connections. The importance of the development of coal mines in Mexico is made obvious by the prices fixed for coal delivered on the cars at Mexican Central Railroad stations. The coal is from the bituminous mines of the Atchison Railroad Company at Starkville, Colo., and Blossburg, N. M. Coke is likewise delivered from Starkville and San Pedro, N. M. The price of coal delivered on the cars at Chihuahua is \$13 (in silver) for 1000 kilograms (about 2200 pounds); the price of coke is \$19. At Zacatecas, the great mining city, coal is delivered for \$17.50, and coke for \$24. At the City of Mexico, the price for coal delivered is \$21.75, and for coke \$28.50.

OHIO.

NATURAL GAS.

On the property of the Adelbert College, at Cleveland, gas has been struck in a well at 85, 100, and 190 feet. The well will be sunk deeper.

PENNSYLVANIA.

ANTHRACITE.

The extent of the fire in the Buck Ridge mine, which resulted in such a terrible calamity at Greenback colliery, a short time ago, made it very doubtful as to whether it could be subdued in less than three months. The work of flooding the burning mine, however, has been vigorously prosecuted, several pumps being employed in forcing water down. Experiments have recently been made, and it is believed that the fire has been extinguished. If this should prove to be the case, the work of pumping out the water will be commenced immediately and pushed as rapidly as possible, though it is hardly probable that, with the greatest effort, the colliery can be put in working condition before the first of January.

The Pine Forest colliery is putting up patent scrapers to scrape the coal to the boilers, instead of wheeling it.

William and Francis Minnich have opened a colliery on Judge Donaldson's land, near Tremont. They have struck a vein about five feet thick.

The Lehigh Valley Coal Company has purchased Montana colliery, a short distance from Mount Carmel, and is pushing the work vigorously preparatory to tunneling to the vein.

A hole 400 feet deep has been completed by the Diamond Drill Company, on the Union Coal Company's track, just above Schwenk, Robertson & Co.'s workings at Mount Carmel. It is reported that four veins were cut, the last between seven and eight feet thick and most excellent in quality. The drill has been put to work at another point, and is expected to reveal still richer mineral deposits.

The Kingston Coal Company will soon put up a new breaker at one of its shafts. Contractors are making estimates.

The Lehigh & Wilkes-Barre Coal Company has made a lease with Charles Parrish and the heirs of Peter Raeder, for the coal under about six acres of land in Wilkes-Barre, for \$2000 yearly, beginning on next January 15th. The royalty for ordinary sizes of coal will be forty cents a ton, and for pea coal twenty cents a ton.

Regular work has begun at the large new breaker recently constructed for the Amity Coal Company at Taylorville, Lackawanna County. The sinkers are actively at work pushing the Pettibone shaft of the Delaware, Lackawanna & Western Coal Company down to the other coal measures.

BITUMINOUS.

According to press dispatches, there is great excitement in the bituminous coal country about the disappearance of W. P. Norton and James Welsh, two sub-contractors employed by the constructors of the Beech Creek, Clearfield & Southwestern Railroad. They were building a road penetrating the country where the mines of the Clearfield Bituminous Coal Company are, and had between 500 and 800 Hungarian and Italian laborers working for them, to whom they owed two months' wages. Norton and Welsh proceeded to Clearfield and removed their deposits, amounting to between \$18,000 and \$19,000, and disappeared. The sheriff immediately seized what property there was belonging to the firm at Bigler and Wallacetown and auctioned it off at public sale. The amount realized was distributed among the laborers, who are in a suffering and starving condition.

COKE.

The H. C. Frick Coke Company has made some experiments with the electric light, with the view to its use in mines. A two-horse dynamo has been placed in the engine-house at the Trotter Works, and supplies electricity for lights in the engine-room and tower at the mouth of the shaft and for four lights at the bottom. There is no doubt of the utility or practicability of the light, but the sole question to be determined is that of cost.

The coke trade exhibits no signs of improvement. There are to-day more idle coke-ovens in the Connellsville region, says the *Courier*, than the trade has known before for years. Of the 9820 ovens, no less than 4417 are smokeless, as against 4043 a fortnight ago. First, there are the 40 per cent shut down of the pool, amounting to 3096 ovens. In addition to these, the Alice works, 200 ovens, are dead because of a lack of water; and the Fairchance, 42 ovens, the Percy, 62 ovens, and the Ferguson, 70 ovens, in all 174 ovens, are smokeless. These works belong to the Coke Producers' Association. They have shut down within the past few days for some mysterious reason known only to the pool managers and by them thus far kept a profound secret. Of the other pool ovens, Standard, Warden, Tip Top, White, Sterling, Enterprise, and Star are idle, being included in the shut-down percentage. Standard is running 87 ovens, but the product goes to the coke crusher; it is not made for the market. Of the independent ovens, Emma is running 18 out of 36, and Redstone 150 out of 313; and of the furnace ovens, Lemont is running 25 out of 152, Youngstown 70 out of 240, and the 100 of Charlotte and Kifer are wholly idle. Stewart, which has been running 60 ovens, is firing up to run full, its owners, the Stewart Iron Company at Sharon, having decided to blow in the furnaces. Fort Hill, which two weeks ago was running 60 out of 98 ovens, is also firing up full. All the other ovens are running full, or in accordance with the pool agreement. Shipments remain at about 525 cars daily. Labor is plenty and prices stationary.

At the Clarissa works of James Cochran & Sons, a permanent water supply has been secured by sinking an artesian well 245 feet deep. This well is six inches in diameter, and will give the Clarissa works an abundant supply of pure water at all times.

It is reported that the members of the Connellsville Coke Producers' Association are not satisfied with the management of the syndicate through whose hands all the coke passes, and that the dissatisfaction will be likely to cause the dissolution of the organization.

NATURAL GAS.

A gas-well has been struck on the Spanish tract, three miles in the rear of Sewickley, in the second or stray sand, giving a flame of twenty feet in length. This well will be drilled to the third sand, and it is expected that it will be a first-class producer.

A heavy vein of salt water was struck at Chess, Cook & Company's well at a depth of 1550 feet, October 4th. The vein is so heavy that drilling is greatly interfered with, the dropping force of the drill being very slight. The water can not be cased off except by the use of 1600 feet of pipe, which will prove too costly, and the firm talks of abandoning the well for the present to see if the salt water vein will cease. Now the water gushes from the hole, and at times is apparently forced up by gas.

The new Westinghouse natural gas line from the Tarentum field will be completed this month. The line will extend along the West Penn Railroad down as far as Herr's Island. From there, a line will be run across the Alleghany River to Pittsburg. Tibby Brothers' glass furnaces and the Spang Steel-Works, Sharpsburg, have made arrangements with the company to introduce the gas.

The following gas and fuel companies, each with a capital of \$15,000, with headquarters at Pittsburg, have been chartered at the State Department: Gas and Fluid Transportation Company, Alleghany County; Gas Fluid Transportation Company, Heat, Light, and Power Company, Wilkins, Sterrett, Alleghany, and Braddock Heat, Light, and Power Companies. These are the companies against the charter of which a protest was made by the Fuel-Gas Company of Pittsburg, on the ground that it possessed a monopoly of the natural gas business in Alleghany County. The matter went into court on an application to enjoin the governor from issuing the charters, but was afterward withdrawn and argued before Secretary Stenger.

GENERAL MINING NEWS.

ARIZONA.

COCHISE COUNTY—TOMBSTONE DISTRICT.

GIRARD.—The new shaft now sinking is a double-compartment one, and is driven rapidly ahead.

GROUND HOG.—In running a drift from the 200-foot level, the ledge was struck about a hundred feet from the main shaft, it proving to be about seven feet thick, none of it being of lower grade than fifty ounces to the ton, and containing a streak of ore about two and a half feet wide, and running from 150 to 300 ounces. Two car-loads of ore, of about fifteen tons each, will be shipped to Socorro or Pueblo, one car of which will run 150 and the other 300 ounces to the ton.

WAY UP.—The mine has been sold by the sheriff by virtue of an execution in the suit of William Grant vs. The Way Up Mining Company to recover \$19,000. The property was bought by Judge Berry, acting for the plaintiff, for the sum of \$5287.40.

WONOCO.—The claims against the company will be liquidated, and the smelter resume operation.

GILA COUNTY.

SAN CARLOS.—The company is erecting a 30-ton water-jacket furnace, with the view of making a thorough working test of the ores in Tweek Camp, situated near the Gila River, 11 miles above the mouth of the San Pedro, and if proving satisfactory, then to erect furnaces on the bank of the river, where it is intended the smelting will be done. The furnaces are said to be not more than twelve miles from the Deer Creek coal-fields.

GRAHAM COUNTY.

DETROIT.—Every thing in connection with this company is reported to be in a prosperous condition.

PINAL COUNTY.

RAY.—This copper company's mines and works have been closed down for the

present, and the men discharged. The cause of this action is said to be the failure of the concentrating-mill to perform the work expected of it.

CALIFORNIA.

MONO COUNTY—BODIE DISTRICT.

Reports for the week ended September 29th :
BODIE CONSOLIDATED.—At the mine, 190 tons of tailings were worked, the average assay value being \$8 a ton. Thirty-five men are employed.

CONSOLIDATED PACIFIC.—The Pacific ledge No. 1 is 16 inches in width, and yields better ore than has hitherto been found. Three assays made during the week showed \$12, \$27, and \$46. The drift on Pacific ledge No. 2 has been run to a total length of 67 feet. This drift is still in very hard working ground, but there is a good strong vein of low-grade milling ore.

MONO.—It is the company's intention to use the old Standard mill for crushing the ore from this mine.

STANDARD CONSOLIDATED.—There were extracted and shipped to the mill 506 tons of ore, also 750 tons of tailings worked. There were received from the ore 825 ounces of crude bullion and from the tailings 362 ounces; and shipped to the company this day \$15,846.22, of which \$10,355.42 is from two weeks' run on ore and \$5490.80 is from two weeks' run on tailings.

HOMER DISTRICT.

BRYANT.—Work has been suspended.

MAY LUNDY.—The bills contracted on behalf of the mine have been settled. The owners have paid 70 per cent, and agreed to pay the balance as soon as the first payment is made on the purchase price of the mine by the May Lundy Company, Limited, of London, which it is believed will soon be made. This arrangement proved satisfactory to all the creditors, and the liens filed were withdrawn and the attachments on the property released. Nothing is yet known of the intentions of the new company, but it is generally believed that possession will be taken soon, and that work will be resumed.

NEVADA COUNTY.

MAGENTA.—The drain tunnel of this mine, which has been in process of construction for several months, has been opened through to a connection with the 200 level. The distance run was 1100 feet, and from the mouth of the tunnel to the incline shaft of the mine the distance is 1400 feet. By means of this tunnel, the surface water, which has heretofore been troublesome in working the mine, can be handled cheaply and effectively.

WASHINGTON.—The old hoisting-works were burnt September 26th.

SAN BERNARDINO COUNTY.

BONANZA KING.—In all the new works in the lower levels, the prospects are promising. The many places now opened and worked are all producing ore. A full complement of men for all work is now at hand. At the mill, every thing is going well.

CANADA.

PROVINCE OF NOVA SCOTIA.

The *Stellarton Trades Journal* states that terms have been arranged between Mr. Grant, the proprietor of the iron ore at East River, and the Canada Steel Company. The company will pay to Mr. Grant a royalty of twenty cents a ton, with two and a half cents a ton extra to Mr. Grant's son as weigher. The company will endeavor to extract an average, as nearly as possible, of one hundred tons a day. Weigh-scales are to be erected in close proximity to the property. The ore meantime will be carted from the new mine to Hopewell, a distance of about six miles. Preparations have begun.

COLORADO.

CHAFFEE COUNTY.

GLADSTONE.—The tunnel on Little Cottonwood is advancing at the rate of nine feet a day. The tunnel is one of the greatest prospecting enterprises in progress in the county. It is now in about 600 feet, and will have to go several hundred feet farther before the prospective vein is intersected.

CLEAR CREEK COUNTY.

CENTENNIAL.—A new strike was made in the lower drift running east from the shaft. A vein of nearly solid ore, four feet in thickness, was opened into, the character of which is iron and copper pyrites and galena.

SEVEN-THIRTY.—The property is actively worked. The underground workings are already quite extensive. The drifts are estimated at two miles in length; 1000 feet having been driven in the first half of the present year. One tunnel level is 1400 feet long, and the 80-foot level shows a slope 1000 feet in length. The property consists of 21 adjoining patented claims, extending over one mile in length along the main vein, and embracing 70 acres of surface ground.

DOLORES COUNTY.

GRAND DUKE.—Work has been resumed by this company, which has not worked its properties for a year.

GRAND VIEW.—The smelter has begun operations.

PASADENA.—The smelter is steadily running on light charges.

GILPIN COUNTY.

GERMAN.—The company has leased the Gregory stamp mill at Black Hawk, and has started it up on ore from the German and Bates-Hunter mines. They still run 40 stamps of one of the Fullerton mills and 15 stamps of the Randolph mill in the same city.

VIRGINIA.—Henry Stearns, of Russell, has secured for two years a new lease and bond of this mine, near the head of Virginia Cañon. Should the present plant of machinery in use be found inadequate, another and heavier plant will be placed on the property.

HINSDALE COUNTY.

HOTCHKISS.—A strike has been made. A great deal of dead-work has been done on this property in trying to find the rich vein that the owners in 1874 lost at a point less than five feet from the present strike.

LAKE COUNTY.

The Leadville *Herald* reports the following: The sorting and jigging by hand of the low-grade ore dumps of this district have been actively pursued the past summer. In some instances, the work proved highly remunerative, and, despite heavy royalties, good profits were realized. In the greater number of cases, only indifferent results were obtained, while not a few ventures resulted in loss to the operators. On Carbonate Hill, where the ore was fairly well adapted to the jigging process, and where an abundant supply was had running over the dumps to be worked, universally favorable results were obtained. The parties working the Evening Star, Morning Star, Waterloo, and other dumps, we believe, all made money. The work accomplished is, however, not satisfactory when viewed from a practical stand-point. Moderate profits, it is true, were derived by both operators and mining companies, but at the same time a great deal of the silver and lead contained in the ore was irretrievably lost. In other portions of the district, where the bulk of concentrating material was hard, or otherwise unfitted for jigging, the accomplishments of the jig hands were even less satisfactory, and many an unsuccessful attempt at jigging is recorded. On Iron Hill, experienced men worked for a long time on the Iron Silver dumps without earning even fair wages. Royalties were reduced again and again, and yet very little money is promised to those who have the enterprise in hand. At present, about thirty men are employed on the Iron mine dumps alone, and quite a number of jigs are worked.

The number of hand-jigs in use in this district will not fall far short of sixty

or seventy. There are about twenty on Carbonate Hill, half as many more in the mouth of Stray Horse Gulch, about twenty in the vicinity of Adelaide, a dozen on Iron Hill, and a number in California and other gulches. The average product per jig per day is about one half-ton of sand, and in addition nearly one fourth-ton of skimmings. This would make a daily production of about 52½ tons. The contents of the concentrates vary very widely, but we presume an average would be fifteen ounces in silver to the ton, and 35 per cent in lead. Assuming these figures to be correct, the daily yield of the jigs, after deducting cost of smelting and hauling, would amount to \$1050. Deducting 30 per cent royalty, there is left \$735 with which to pay seventy jig men \$3.50 a day, about fifty other laborers, besides teams engaged in hauling ore from the dumps to the jigs, water rents, and other expenses.

In the working over of most dumps, a great deal of hard ore is also obtained, which is sorted out by the shoveler of the dump material into the sluice-boxes. A great many dumps are also only hand-sorted, and possibly screened. This latter method of working over dumps has proved very satisfactory in many instances, and its results, added to the jigging business, has unquestionably contributed to the product of the camp for a number of months past from 90 to 120 tons of valuable material a day.

BRIAN BORU.—A report states that this mine has been sold for \$40,000.

DENVER CITY.—The mine continues in a fair body of from twenty to thirty-ounce ore. A small pocket of rich mineral was encountered, but has already been exhausted. The mine now is more than paying expenses. The indebtedness of the company is variously placed at \$23,000 and \$28,000, of which amount \$15,000 was incurred in purchasing the alleged claim of Mr. Rivcux to a quarter interest. When the annual statement of the company was issued on January 1st, 1884, the obligation of the company did not exceed \$8000.

IRON SILVER.—The lessees of the Buck lease on the Kayserine lode of the Iron Silver consolidation are shipping about twenty five tons of iron ore a day, which contains from twenty to forty-five ounces in silver to the ton. In following the ore-chute, the incline from the bottom of the shaft has now advanced nearly two hundred feet. The chute so far has proved continuous, but of varying strength. At present, it is only about eight feet wide, but discloses some fine ore in the face.

LA PLATA MINING AND SMELTING COMPANY.—The company contemplates the erection of desilverizing works in the near future. The establishment is to be situated in some centrally located town in the East.

TIGER CONSOLIDATED.—An assessment has been levied for the purpose of meeting the expenses incurred by litigation. The property is worked under a lease.

PARK COUNTY.

WYANDOTTE.—The attempts to free the shaft from water have been unsuccessful, and work has been commenced from the tunnel side. It is proposed to connect the tunnel and the shaft and open a 100-foot drift for the ore taken out.

PITKIN COUNTY.

ASPEN SMELTING COMPANY.—The company has appointed Walter B. Devereux its duly authorized business agent.

SPAR CONSOLIDATED.—A contract has been made with the smelting company for the delivery of 2300 tons of ore.

GEORGIA.

LUMPKIN COUNTY.

On account of the continued dry weather, work at most of the mines and mills has been stopped.

IDAHO.

ATLANTA HILL—In the suit of Matthew Graham and Philip Reilly against the Atlanta Hill Gold Mining and Milling Company, brought to set aside a mortgage of \$100,000 that the company made about a year ago to secure its bonds, Judge Andrews, of the Supreme Court, Special Term, New York City, has decided that the mortgage was valid. The plaintiffs, who were stockholders, claimed that the company had no right to mortgage its property except to pay its debts.

BIG CAMAS, No. 2.—Preparations are making for the erection of a mill. This mine was sold a few months ago to capitalists of St. Joseph, Missouri, for \$10,000 cash. The ledge is said to be over 100 feet in width, and the ore assays \$40 in gold per ton.

MAMMOTH.—The owners of these copper mines, Lost River, report the arrival of the machinery for the smelter. They employ seventy-five men. Coke and flux have been secured.

PARKER.—A contract has been made with Parke, Lacy & Co., of Salt Lake City, for a complete outfit of boiler, engine, air-compressor, pump, drills, etc., for the mine. Without machinery, the mine has netted \$35,000 during the past six months.

QUEEN OF THE HILLS.—The first shipment from this mine has been made, and is to be followed by at least one car a day hereafter. The concentrator has got to work, and the prospects of the mine are good.

MEXICO.

The correspondent of the *Financier* at Real del Monte writes that on the 17th of September the Dolores engine was started, after an idleness of eight years. The machinery is in good condition, although it has been in operation for over fifty years. When it was announced that the engine would be worked continually in future, crowds of people gathered to see it; bands of music played; and fire-works and a grand ball given by the prominent citizens were the attractions of the evening. Too much importance can not be given to this event, as it is really an immense benefit to the State of Hidalgo, and especially to the capital of the State. The Jesus Maria is making a good showing at the water-level, and one of the greatest bonanzas ever seen in Real del Monte is expected as soon as the engine has finished draining the big Carretera lode.

La Descubridora, in Cerro Verde, District of Mazatlan, is in bonanza, the report being that so great a quantity of ore is now put out that all of it can not be reduced by a large machine imported for that purpose from the United States.

MICHIGAN.

HYDRAULIC POWER COMPANY.—The additional pair of Rand air-compressors for the company's plant, at Quinnesec Falls, on the Menominee River, are going into place, and will soon furnish the mines at Iron Mountain with compressed air to drive their hoisting and drilling machinery. When this increased, it is believed the compressors will be able to furnish all the power needed for the present.

COPPER MINES.

The September reports of the output of the Lake Superior copper mining companies compare as follows with those for the same month last year:

	1884. Tons.	1883. Tons.
Calumet & Hecla.....	2,335	1,679
Quincy.....	536	336
Atlantic.....	193	159
Franklin.....	182	188
Huron.....	121	58
All uze.....	120	105
Peninsula.....	62	31
Hancock.....	39	37

The September output of the Calumet & Hecla was the largest monthly production in the history of the mine.

CONGLOMERATE.—The management is carrying on a line of prospecting to the south of the deposit now mining. One of the lodes that will be properly tested is the presumed Calumet conglomerate belt.

IRON MINES.

Lake shipments of iron ore from the ports of Marquette District for September amounted to 312,468 gross tons. This brings the total output by lake to date for the season of 1884 up to 2,046,531 gross tons, or within 304,841 tons of the entire product of the district in 1883.

BEAUFORT.—Operations have been suspended for the winter.

DETROIT.—The shaft has reached a depth of 300 feet; and when five feet more have been sunk for a sump, no further work in this direction will be done for some time to come. A drift to reach the 30-foot ore-body that was struck last summer by the diamond drill is now within about ten feet of the ore, and will probably reach the deposit in a few days. Farther on, and on the trend of the vein, a second drill-hole cut through 70 feet of fine ore.

HUMBOLDT.—The mine has been closed temporarily.

LAKE SUPERIOR.—At one point in No. 7 mine, a drift of considerable length has to be made to reach an ore-body, and the ventilation will be poor. It is the desire to secure a current of air, and instead of sinking a winze, which course is usually adopted, a 5-inch diamond drill-hole will be put through. The distance to be cut is about 250 feet. This will be the largest hole, in diameter, ever bored in this region, and should the trial prove successful, no doubt similar ones will be put down when needed.

LOWTHIAN.—The mine has closed down for the season.

NEW BARNUM.—The B shaft is almost unwatered.

MONTANA.

GALLATIN COUNTY.

CAMBRIAN.—The company, which recently purchased the Menor copper lode at Emigrant Gulch, has begun work on the development of the property, and is making arrangements to carry on work throughout the winter.

NEVADA.

ELKO COUNTY—TUSCARORA DISTRICT.

BELLE ISLE.—The company held its annual meeting at San Francisco September 26th. The cash on hand amounts to \$14,642.38. The superintendent's report shows that the workings the past year have reached the depth of 450 feet. On the 450 level, a drift has been extended north from the south line a distance of 200 feet, following a large vein formation; at times, small stringers of ore were encountered, assaying about equally in gold and silver, as high as \$40 a ton, but no ore in paying quantities has been found on this level so far as it has been explored. A cross-cut has been extended west a distance of 45 feet, at the north end of the drift, and also a cross-cut to the east 155 feet, connecting with a winze from the 350-foot level. The latter work secures good ventilation to this level. On the 350-foot level, drifts, cross-cuts, winzes, and uprisings were driven to the amount of 1567 feet. In both No. 2 and 3 drifts, a little good ore was encountered, but has not yet been explored sufficiently to determine its probable value. The most encouraging developments made the past year have been on the 250 and 150 levels, on a vein that has not been reached yet on the lower levels. At the south line on the 250 level, a joint Belle Isle and Navajo cross cut was driven east to what is now known as the east vein. No drifting has been done at this point, but an uprise has been carried up on the vein 78 feet to date, and in this distance a fair-sized vein has been developed, and the ore will average between \$100 and \$200 per ton. On the 150-foot level, a cross-cut reached the vein at a distance of 55 feet. At this point, the ore showed a width of 3 feet. A drift is driving north, and has gained a distance of 40 feet. The ore has not remained the width where first encountered, but has retained a good average width and grade of ore so far as it has been explored. The prospects are most flattering for a continuation of the ore as the work is forwarded north. Such openings in the old workings as may be required in future explorations have been kept in good repair. Such favorable prospects, and the recent developments on the same vein in an adjoining property, seemingly assure an output of ore for the coming year.

NAVAJO.—A better grade of ore is sent to the mill, and bullion shipments are steadily increasing.

HUMBOLDT COUNTY.

PARADISE VALLEY.—The report for fourteen months, ended August 31st, presented at the annual meeting recently held at San Francisco, showed that bullion valued at \$215,259, had been produced, and that two dividends, each of \$15,000, had been paid.

STOREY COUNTY—COMSTOCK LODGE.

CHOLLAR.—In the court at San Francisco, September 29th, the judge gave his decision in the matter of the application of the newly elected directors of the Chollar Mining Company for certificates of election and for the possession of the books and papers of the corporation, deciding in their favor. The Sharon side gave notice of appeal.

NEWFOUNDLAND.

COLONIAL COPPER MINING COMPANY.—A correspondent of the *St. John Telegraph* writes that this company, at Dorchester, employs 45 men. Since the company began operations, it has shipped large quantities of the finer grades of ore to Boston. In addition it has now on the dump \$30,000 worth of the lower grades of material, yielding from 4 to 7 per cent of metal, and Mr. Revere, the manager, is now in Boston selecting machinery to crush and concentrate the ore, besides several power-drills to increase the output of the mine. The mine is now turning out the best quality of gray copper ore ever produced in this vicinity from the west drift, 100-foot level. It is estimated that the additional machinery that the company is about to purchase will cost \$20,000, and will enable it to fully develop the copper deposit it is working. All the ore now mined is raised by steam, and the machinery employed is of the best quality.

NEW MEXICO.

PIÑOS ALTOS.—Owing to a scarcity of water, the mill of the Piños Altos Gold and Silver Mining Company shut down on the first of October. The search for water will be prosecuted by digging wells, perhaps by putting down an artesian well.

UTAH.

BEAVER COUNTY.

JOHN KEMPLE.—A mill is to be erected on a small scale, and is to be increased as results may justify. The mine has four parallel veins striking east and west, and within 150 feet of each other. The deepest working is an incline 50 feet.

BOX ELDER COUNTY.

NORTHERN CHIEF.—Reports state that this property has been attached.

SALT LAKE COUNTY.

EMMA.—It is thought that if the late storms had not come, the machinery could have started about the first of October.

SUMMIT COUNTY.

CRESCENT.—The tramway is finished. The concentrating mill is up, but setting the machinery is delayed by the Cornish rolls failing to arrive. The mine looks better than ever, and is shipping from fifty to sixty tons of ore a day.

FINANCIAL.

Gold and Silver Stocks.

New York, Friday Evening, Oct. 10.

The activity in the mining market at the beginning of the week has fallen off considerably the past two days. This is probably due to political matters, which attracted the attention of many on Thursday.

Consolidated Pacific has been the feature, and considerable interest was manifested in the dealings of this stock. The prices varied greatly—the highest being \$1.05 and the lowest 60c.—the sales amounting to 13,500 shares. Considerable business has been done with California and Consolidated Virginia both firm, the former selling at from 42@37c., and the latter at from 27@22c.

A few sales of Robinson Consolidated are recorded at prices from 21@30c. There have been quite lively dealings in various other stocks ; but there is nothing of special interest to report.

DIVIDENDS.

DIVIDENDS PAID BY MINING COMPANIES DURING THE MONTH OF SEPTEMBER AND FROM JANUARY 1ST, 1884.

Table with columns: NAME OF COMPANY, Location of mines, Paid during month of September, Since January 1st, 1884.

G, gold ; S, silver ; L, lead ; C, copper ; Q, Quick-silver ; C, coal ; L, Iron ; M, mica.

Adams Mining Company, of Colorado, has declared dividend (No. 2) of ten cents a share, or \$15,000, payable October 20th, at the office of the Farmers' Loan and Trust Company, Nos. 20 and 22 William street.

Hope Mining Company, of Montana, has declared

dividend No. 12 of one and a half dollars a share, payable October 1st.

Rooks Mining Company, of Vermont, has declared dividend No. 3 of twenty-five cents a share, payable October 25th, at the Treasurer's office, Room 8, Tremont Temple, Boston, Mass.

Valencia Mica Company, of New Hampshire, has declared a quarterly dividend of two and a half dollars a share, payable October 15th.

ASSESSMENTS.

Table with columns: States, Amount per share, Delinquent in office, Day of sale.

PIPE LINE CERTIFICATES.

Messrs. Watson & Gibson, petroleum brokers, No. 49 Broadway, report as follows for the week :

The market shows but small fluctuations, owing to uncertainty as to the new field at Baldrige. The highest price this week was 75½ and the lowest 72½.

The following table gives the quotations and sales at the New York Mining Stock and National Petroleum Exchange :

Table with columns: Opening, Highest, Lowest, Closing, Sales.

Boston Copper and Silver Stocks.

[From our Special Correspondent.]

BOSTON, Oct. 9.

The market for copper stocks the past week has been tame enough, and transactions confined principally to Calumet & Hecla, which early in the week was firm at \$145, the closing sale of last week ; but later, on the report of a fire in the mine, there was a rush to sell stock, resulting in a decline of \$6, with private sale at \$138.

ola sold at \$9, same as last sale. The above were the only stocks dealt in the past week, the aggregate of sales being 260 shares only, and serves to show the extreme dullness of the market.

In silver stocks, there were no transactions at the Boston Stock Exchange, and at the Mining Board there was but little doing.

3 P.M.—The market this afternoon was unchanged. Calumet & Hecla sold at \$145. Quincy, at \$28½, closing \$27½ bid.

SAN FRANCISCO MINING STOCK QUOTATIONS.

Daily Range of Prices for the Week.

Table with columns: NAME OF COMPANY, CLOSING QUOTATIONS (Oct. 3, 4, 6, 7, 8, 9).

BULLION MARKET.

NEW YORK, Friday Evening, Oct. 10.

BULLION PRODUCTION FOR 1884.

Table with columns: MINES, States, Month of August, Year from Jan. 1st, 1884.

Total amount of shipments to date.....\$11,517,183

* Official. † Assay value. ‡ Not including value of lead and copper ; G. Gold ; S. Silver ; L. Lead ; C. Copper. No bullion produced. Silver valued by the different companies from \$1.05 to \$1.19 per ounce ; gold, \$20.67.

@2-75c. for Shell; 1c. more for Flange; and 3-50c. for Steel Plates.

Structural Iron.—Rumors have been afloat on this market for some weeks about large orders for structural iron, but particulars can not be had at present. Some large requirements will probably be presented. The mills just now are in need of something of this kind. Angles are 2-10c.; Bridge Plates, 2-25c.; Tees, 2-75c.

Sheet-Iron.—Sheet-iron is quietly held at old prices.

Nails.—Nails are selling at \$2 10@2.20, and the steel product is favorably received.

Wrought Pipe.—The manufacturers of wrought pipe have been selling a little more this week, for delivery next month. Discounts are 45 and 35 respectively for black and galvanized, butt welded, and for lap welded 60 and 45 respectively for black and galvanized.

Steel Rails.—Steel rail makers are endeavoring to fix \$30 as the price for future delivery of rails, but it is likely that \$28 for a satisfactory order would be taken by almost any one of the mills at this time. The mills have over four months' work on hand, and are indifferent, or apparently so, as to business, although they are by no means out of the woods of low prices. Buying interests say that this upward tendency will reach its limits, and there will be a return to \$27. A good deal of business is quietly secured, and the rail-makers are disposed to meet buyers half-way, in order to make sure of business for the early spring.

Old Rails.—Southern rails have sold for delivery here at \$18. Average figures, \$18@19, according to size of order. Business has been dull, but there are a good many inquiries.

Scrap-Iron.—A few sales of cast turnings were made at \$8.50@9.50. Cargo lots of foreign are worth \$17.50. No. 1 Wrought, \$19@20.

COAL TRADE REVIEW.

NEW YORK, Friday Evening, Oct. 10.

Anthracite.

The natural demand of the season for such sizes as stove and egg has led to greater activity, though there has been no improvement whatever in price, and the scarcity of cars for Western shipment has led to some buying on that account. Other sizes are plentiful, especially chestnut, and there is the constant danger that the coal companies, in their eagerness to furnish the full quota of stove coal, will smother the market with the other kinds. Those of the companies who have been for a long time quietly selling ahead at concessions are in comparatively good shape; the others, however, are so well stocked that there is no danger whatever of any deficiency in the supply. Buyers thoroughly understanding this, are without the slightest anxiety as to the future, especially those in near-by markets, who know that the narrowing of the market at the close of navigation will afford them all the opportunities for favorable purchases that they may require. We quote, f. o. b., Stove coal, \$3.75@4; Chestnut, \$3.25@3.50; and Pea, \$2.25.

Bituminous.

Freights continue very low, being \$1.05 to Boston from Baltimore. Business is dull and prices continue low, with the range of \$2.80@3.50 according to the quality of the coal, which is beginning to be more closely scrutinized by buyers.

Philadelphia.

Oct. 10.

[From our Special Correspondent.]

Stocks at Port Richmond to-day are 82,000 tons. The Reading will not take any more orders for this season for Lykens Valley coal. That company is rebreaking its larger coals, to meet the active demand for stove and nut, the stocks of which are short. Special coals are in light supply. Certain inferior coals are offered at reductions, and a few good contracts have just been made for immediate delivery. There seems to be a disposition on the part of some Eastern buyers to depart from their policy of inaction, and to purchase larger stocks. Negotiations to this end are pending, but there is some difference as to price. The Eastern demand is a little backward, as usual, and as long as there is so much inactivity in industrial channels there, it is not to be expected that demand will assume very heavy proportions; but the feeling is expressed here that the New England market will come out all right. The scantiness of stocks there is a strong argument in favor

of it. The demand will not grow fast enough to prevent a week's stoppage in November. The Reading, and possibly one other company, might get along without it, so far as orders are concerned; but in the interests of firm prices, a restriction will be ordered, though no definite arrangements have been entered into as to how and when. The shipments West are still rather light. The line trade shows no improvement. Domestic demand is quite active, and some yards are sold away ahead. The *Record* departure is attracting a great deal of attention, and sales are increasing.

The bituminous coal operators have nothing worth reporting, but with all that, they are selling their share of coal, and laying the foundation for a big business next year, which some of them believe will result in displacing no small amount of anthracite. Some parties who had partly developed coal properties have discontinued work, on account of the unfavorable outlook for selling coal. The operators expect to enter into arrangements with railroad companies that will extend their markets in the West. The production of the Clearfield region, for the week just reported, was 72,748 tons, against 63,421 tons for the corresponding week last year. The production to date this year is 2,372,901 tons, an increase of 227,835 tons, as compared with the production for the same time last year. The output of the Cumberland region for the same week was 38,055 tons, a decrease of 2516 tons, as compared with the same week last year, and the total production to date 1,394,602 tons, showing an increase of 129,488 tons, as compared with the same time last year.

Buffalo.

Oct. 9.

[From our Special Correspondent.]

Trade in anthracite coal is moderate for local and near-by consumption at unchanged quotations. Stocks are light, in consequence of the suspension in mining operations. Rumors of further limiting productions are current, but are not traceable to any reliable source.

Bituminous coal continues low in price, and the features peculiar to the trade continue.

Coke is unchanged. There are more idle coke-ovens in the Connellsville region than have been known before for many years. The resumption of manufacturing industries is hoped for in the near future.

Coal freights are gathering strength, but no settled advance is obtained. Several vessels were chartered to Milwaukee at 70c., but 60c. was the going rate to Chicago, for no larger figures were paid. The demand for tonnage to Lake Michigan ports was very light, and coal has been in scant supply, but the arrivals are expected to increase now that work is resumed at the mines. It is quite probable that November 1st will see a virtual close of the marine season, unless freights up and down soon improve. Most of the medium-sized vessels will then lie up, and their insurances be canceled. At Chicago, there is more idle tonnage in port now than at any previous time this season, and the amount is increasing daily.

The engagements by lake from this port for the week were at the following rates: 60c. to Chicago and Milwaukee (five small vessels to latter port at 70c.); to Duluth on contract; 20c. to Toledo; 15c. to Sandusky; 60c. to Green Bay; 80c. to Bay City; 30c. to Saginaw; 70c. to Racine; 60c. to Marquette and the Sault; and to Superior City on contract. Closing firm, with upward tendency.

The shipments by lake from October 3d to 9th, both days inclusive, were 83,195 tons; namely, 18,370 tons to Chicago, 9460 to Milwaukee, 1385 to Toledo, 2500 to Duluth, 500 to Sandusky, 300 to Bay City, and 680 to Green Bay.

Receipts by lake for the week, none.

Receipts by Lake Shore & Michigan Southern Railroad for the week, 1128 tons; 780 tons for Buffalo, and 348 tons for other points.

Receipts by canal for the week, 5978 tons; shipments for the same period, 1527 tons.

Coal charters by canal for the past week include 1 load to Lyons at 65c. net ton, and 4 loads to Syracuse at 65c. gross ton; captain to pay unloading in all cases. The nominal asking rate to New York \$1.40, and to Albany \$1.20 per net ton, captain to pay unloading.

Messrs. Peugeot & Trotter have purchased the coal business of Mr. Henry A. Townsend, No. 14 West Swan street.

Our neighbors of Tonawanda, ten miles from

Buffalo, have filed articles of incorporation for a new gas company; capital stock, \$50,000.

Messrs. Thomas Loomis & Co. have removed their office into the White Building, Main street.

It is stated that the Fletcher Furnace Company, at Black Rock (the particulars of their closing I sent you some time since), lost fully \$200,000 in the venture, and the works were only in operation about three years.

The Buffalo, New York & Philadelphia and the New York, Lake Erie & Western railroads have notified their customers that all coal must be consigned directly from the mines to destination, and can not be reconsigned from here. Dealers will necessarily carry smaller stocks on the track in future, and consumers, to make themselves sure of supply, will have to purchase in advance of their consumptive requirements, or else they may find themselves short of fuel in the winter months when experiencing the effects of snow blockades.

The matter of adjusting freight rates on coal by the New York, Lake Shore & Western, the Lake Shore & Michigan Southern, the Rochester & Pittsburg, and the Buffalo, New York & Philadelphia railroad companies has been referred, it is said, to the general coal agents of the several mining companies interested. The plan most favored is understood to be the appointment of a commission by whom all points of difference will be considered and determined.

The propeller Onoko left Buffalo for Chicago on her last trip with a cargo of 2700 net tons of coal. This is a fair specimen of the capacity of our lately constructed lake vessels.

An exchange asserts, with evident belief in the truth, that some of the strikes in the coal regions have been organized in behalf of the coal corporations, in order to suspend production and thus enhance prices and limit supply. "It is evident that all the fools are not dead yet," says a friend at our elbow.

Over 200 feet of coal-docks at Port Arthur, Lake Superior, were washed away by a late storm.

The receipts of coal at Duluth, Minn., for the past two weeks were 23,945 tons; total for the season thus far, 245,292 tons.

Boston.

Oct. 9.

[From our Special Correspondent.]

The important event since last writing has been the nominal reduction in company prices of stove coal in this market to a basis of \$4. The movement created no excitement and has not stimulated trade to any extent. It is simply an open avowal of actual prices. As we have said before, no large amount has been put on by retailers in this market at anything like \$4 25 f. o. b. at New York. That figure has been entirely nominal. Considerable coal has been bought at \$4.10 @ \$4.15; but perhaps four fifths of the coal bought in cargo lots this year has been at \$4@4.05, or its equivalent at Philadelphia. The market for October now returns to March prices, an unusual thing, to be sure, but the companies themselves are at fault, if fault there be. Their policy of production, or rather over-production, was such that neither the advance of 10 cents in June nor of 15 cents in July has been realized. It is better for all concerned that there should be a return to quotations that mean something.

Outside coal is selling at \$3.75@3.90 f. o. b., at New York for Stove, though \$3.75 coal is said to be of doubtful value.

We revise f. o. b. quotations for cargo lots as follows: At New York, Stove, \$4@4.15; Broken and Egg, \$3.50@3.65; Pea, \$2.40; individual coals, \$3.75@3.90 for Stove, \$3.25@3.50 for Broken and Egg. At Philadelphia, \$3.90@4 for Stove, \$2.20 for Pea, \$3.30@3.50 for Broken and Egg. Special coals, \$4.85@5 for Broken, \$5.35@5.50 for Stove.

The trade realizes that all hope of improvement rests in the weather. It is not likely that prices will stiffen materially. Broken coal is in abundant supply at all points, and moves very slowly. Chestnut is in such small demand that it is not worth quoting. No one buys a cargo lot outside of Worcester, New Bedford, Fall River, and a few localities in that neighborhood. Retailers here get a sufficient supply of Chestnut by screening broken coal. Pea coal is in larger supply at tide-water, and offering at \$2.40 in New York, and \$2.20 in Philadelphia.

The market for bituminous coal has been very quiet. No one is endeavoring to sell coal. The fire that occurred in a large lot of bituminous at the Hamilton Manufacturing Company's mills at Lowell has caused considerable gossip, and anthracite men

are talking as though such occurrences would bring back to them a portion of their lost, strayed, or stolen trade.

There is a slightly firmer feeling in freights, as many vessels have left the trade temporarily, but there are plenty left, as quotations show.

There is a very good retail trade. The nominal decline in the wholesale market has no effect, and quotations are unchanged.

White ash, furnace, and egg... \$5.50
Red ash, egg... 6.00
Lorberry, egg and stove... \$8.75 @ 7.00

FREIGHTS.

Coastwise Freights. Per ton of 2240 lbs. Representing the latest actual charters to October 10th.

Table with columns for Ports, From Philadelphia, From Baltimore, and From Elizabethport, Port Johnston, South Amboy, Hoboken, and Weehawken.

* And discharging. † And discharging and towing. ‡ 3c. Per bridge extra. § Alongside. ¶ And towing up and down. ** Below bridge.

George W. Jones & Co.

STATISTICS OF COAL PRODUCTION

Comparative statement of the production of anthracite coal for the week ended October 4th, and year from January 1st:

Table with columns for Tons of 2240 Lbs., 1884 (Week, Year), and 1883 (Week, Year). Rows include Wyoming Region, Lehigh Region, Schuylkill Region, and Sullivan Region.

* Included in tonnage of the Philadelphia & Reading Railroad.

The above table does not include the amount of coal consumed and sold at the mines, which is about six per cent of the whole production.

Table showing Total same time in 1879, 1880, 1881, and 1882.

Comparative Statement of the Production of Bituminous Coal for the week ended October 4th, and year from January 1st:

Table with columns for Tons of 2000 pounds, 1884 (Week, Year), and 1883 (Week, Year). Rows include Cumberland Region, Barclay Region, Broad Top Region, Clearfield Region, Monongahela Region, and Pennsylvania RR.

Belvidere-Delaware Railroad Report for the week ended October 4th:

Table with columns for Week, Year 1884, and Year 1883. Rows include Coal for shipment at Coal Port (Trenton), Amboy, Coal for distribution, and Coal for company's use.

Advertisement for LINK BELTING MACHINERY Co. featuring an image of a vertical hoist and text: 'Manufacturers of IMPROVED ELEVATORS & CONVEYORS FOR HANDLING COAL COKE & ORES BROKEN STONE SAND ETC.'

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DIVIDENDS. 53 BROADWAY, NEW YORK CITY, Oct. 6, 1884. THE ROOKS MINING COMPANY HAS declared its THIRD DIVIDEND of \$12,500, being 25 cents per share and 10 per cent on its capital stock, payable October 25th, 1884.

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